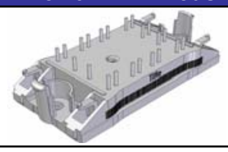
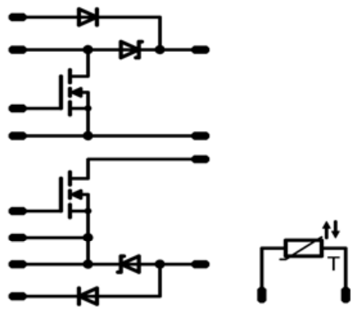
flowBOOST0 **600V/45mΩ**

Features
- High efficiency symmetric boost
- Ultra fast switching frequency
- Low Inductance Layout
- Tandem to FZ06NIA045FH and FZ06NIA045FH01

flow0 12mm housing


Target Applications
- Neutral point solar inverters

Schematic


Types
- 10-FZ06NBA045FH-P915L

Maximum Ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Bypass Diode					
Repetitive peak reverse voltage	V_{RRM}			1600	V
Forward current per diode	I_{FAV}	DC current	T_h=80°C T_c=80°C	43 58	A
Surge forward current	I_{FSM}	t_p=10ms	T_j=25°C	370	A
I2t-value	I^2t		T_j=150°C	370	A^2s
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	49 75	W
Maximum Junction Temperature	$T_j$max			150	°C
Input Boost MOSFET					
Drain to source breakdown voltage	V_{DS}			600	V
DC drain current	I_D	T_j=$T_j$max	T_h=80°C T_c=80°C	36 44	A
Pulsed drain current	I_{Dpulse}	t_p limited by $T_j$max		230	A
Power dissipation	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	125 189	W
Gate-source peak voltage	V_{GS}			±20	V
Maximum Junction Temperature	$T_j$max			150	°C

Maximum Ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Input Boost FWD					
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25°C		600	V
DC forward current	I_F	T_j=$T_j$max	T_h=80°C T_c=80°C	23 29	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		70	A
Power dissipation	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	51 77	W
Maximum Junction Temperature	$T_j$max			175	°C
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{op}			-40…+(Tjmax - 25)	°C
Insulation Properties					
Insulation voltage	V_{is}	t=2s	DC voltage	4000	V
Creepage distance				min 12,7	mm
Clearance				min 12,7	mm

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Bypass Diode										
Forward voltage	V_F				15	Tj=25°C Tj=125°C	0,8	1,10 1,05	1,3	V
Threshold voltage (for power loss calc. only)	V_{to}				15	Tj=25°C Tj=125°C		0,90 0,78		V
Slope resistance (for power loss calc. only)	r_t				15	Tj=25°C Tj=125°C		0,007 0,009		Ω
Reverse current	I_r			1200		Tj=25°C Tj=125°C			0,1	mA
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,42		K/W
Input Boost MOSFET										
Static drain to source ON resistance	$R_{DS(on)}$	V_{CE}=V_{GE}	10		44	Tj=25°C Tj=125°C		0,042 0,083		Ω
Gate threshold voltage	$V_{(GS)th}$		V_{GS}=V_{GD}		0,003	Tj=25°C Tj=125°C	2,1	3	3,9	V
Gate to Source Leakage Current	I_{gss}		20	0		Tj=25°C Tj=125°C			200	nA
Zero Gate Voltage Drain Current	I_{dss}		0	600		Tj=25°C Tj=125°C			25	µA
Turn On Delay Time	$t_{d(ON)}$	Rgon=4 Ω Rgoff=4 Ω	10/0	400	15	Tj=25°C Tj=125°C		20 19		ns
Rise Time	t_r					Tj=25°C Tj=125°C		5 6		
Turn off delay time	$t_{d(OFF)}$					Tj=25°C Tj=125°C		132 144		
Fall time	t_f					Tj=25°C Tj=125°C		240 86		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=125°C		0,077 0,081		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=125°C		0,027 0,026		
Total gate charge	Q_g		10/0	400	15	Tj=25°C Tj=125°C		150	190	nC
Gate to source charge	Q_{gs}					Tj=25°C Tj=125°C		34		
Gate to drain charge	Q_{gd}					Tj=25°C Tj=125°C		51		
Input capacitance	C_{iss}	f=1MHz	0	100		Tj=25°C		6800		pF
Output capacitance	C_{oss}							320		
Reverse transfer capacitance	C_{rss}							4,5		
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						0,56		K/W
Input Boost FWD										
Forward voltage	V_F				16	Tj=25°C Tj=125°C	0,9	1,52 1,66	1,75	V
Reverse leakage current	I_{rm}		10/0	400		Tj=25°C Tj=125°C			400	µA
Peak recovery current	I_{RRM}	Rgon=4 Ω	10/0	400	15	Tj=25°C Tj=125°C		17 16		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		9 10		ns
Reverse recovery charge	Q_{rr}					Tj=25°C Tj=125°C		0,120 0,089		µC
Reverse recovered energy	E_{rec}					Tj=25°C Tj=125°C		0,027 0,014		mWs
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=125°C		5076 4101		A/µs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,87		K/W

Characteristic Values

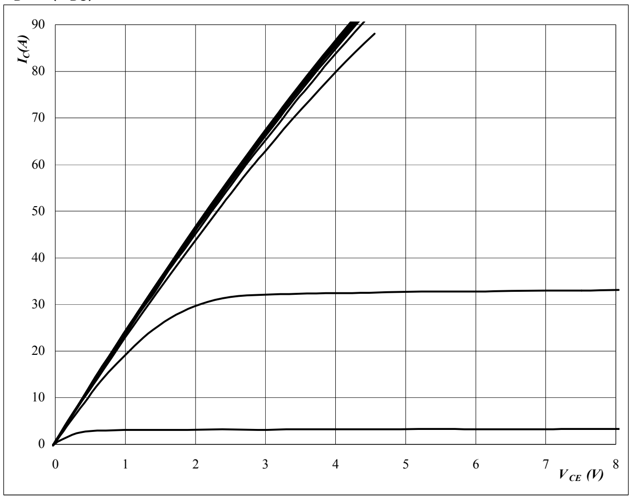
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
Thermistor										
Rated resistance	R					Tj=25°C		22000		Ω
Deviation of R100	$D_{R/R}$	R100=1486 Ω				Tc=100°C	-5		+5	%
Power dissipation	P					Tj=25°C		200		mW
Power dissipation constant						Tj=25°C		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				Tj=25°C		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				Tj=25°C		3996		K
Vincotech NTC Reference									B	

INPUT BOOST

Figure 1 BOOST MOSFET

Typical output characteristics

$I_D = f(V_{DS})$



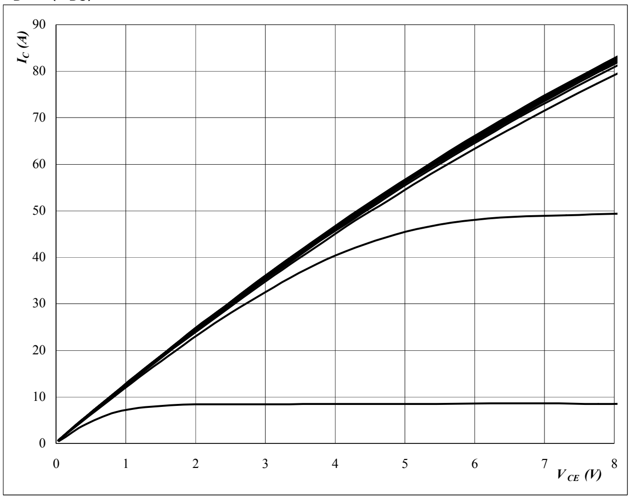
At

t_p =	250	µs
T_j =	25	°C
V_{DS} from	4 V to 14 V in steps of 1 V	

Figure 2 BOOST MOSFET

Typical output characteristics

$I_D = f(V_{DS})$



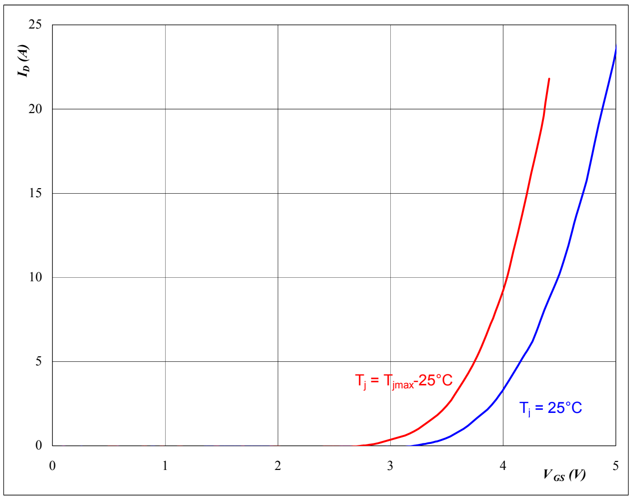
At

t_p =	250	µs
T_j =	125	°C
V_{DS} from	4 V to 14 V in steps of 1 V	

Figure 3 BOOST MOSFET

Typical transfer characteristics

$I_D = f(V_{DS})$



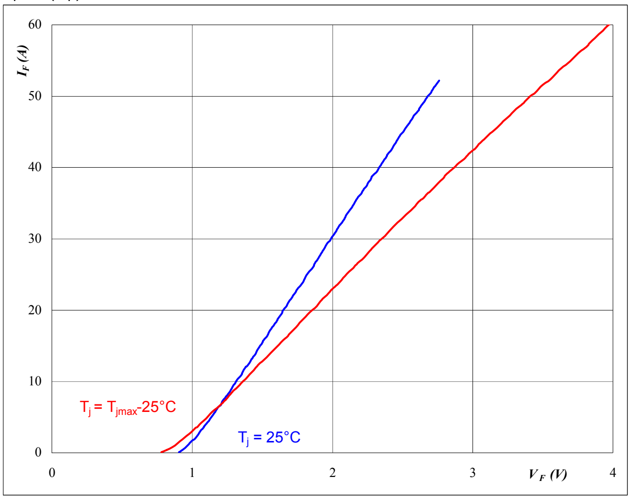
At

t_p =	250	µs
V_{DS} =	10	V

Figure 4 BOOST FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

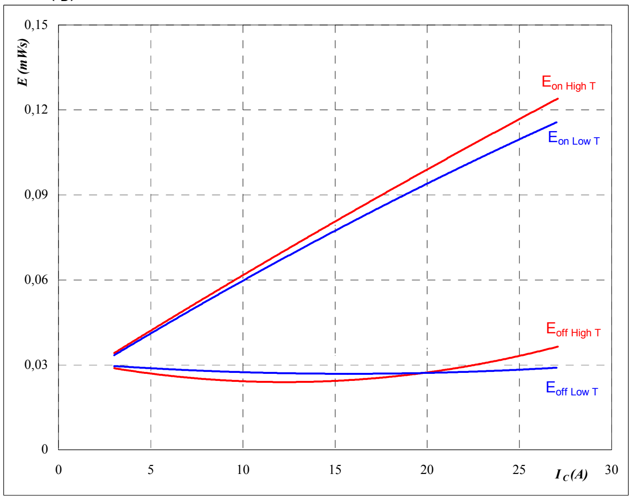
t_p =	250	µs

INPUT BOOST

Figure 5 BOOST MOSFET

Typical switching energy losses as a function of collector current

$E = f(I_D)$



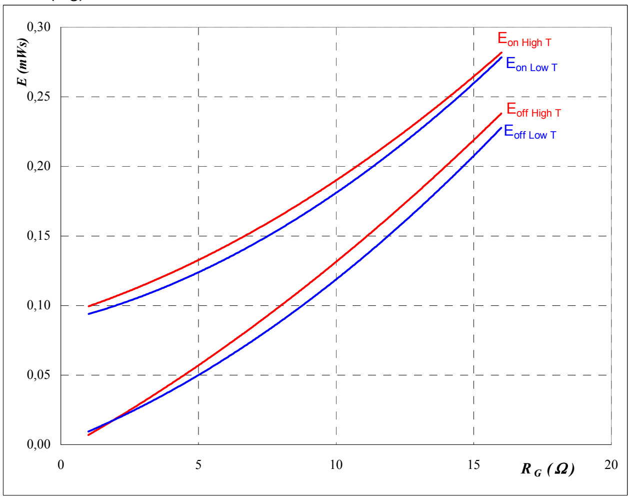
With an inductive load at

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	+10/0	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 6 BOOST MOSFET

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



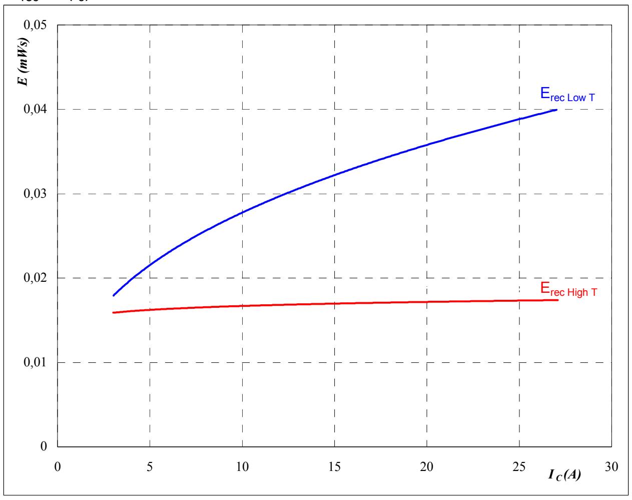
With an inductive load at

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	+10/0	V
I_D =	27	A

Figure 7 BOOST MOSFET

Typical reverse recovery energy loss as a function of collector (drain) current

$E_{rec} = f(I_c)$



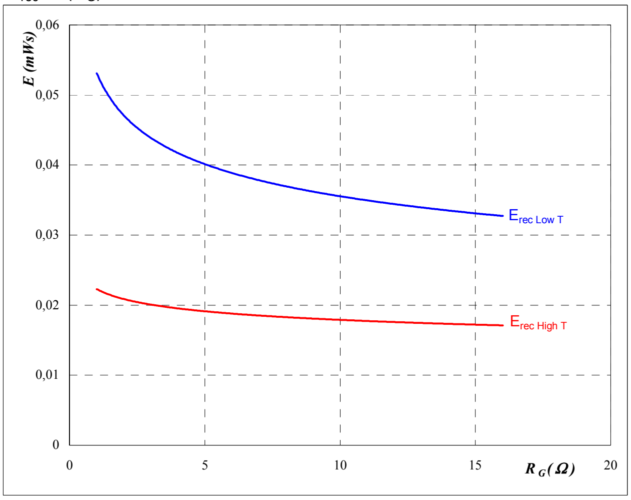
With an inductive load at

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	+10/0	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 8 BOOST MOSFET

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

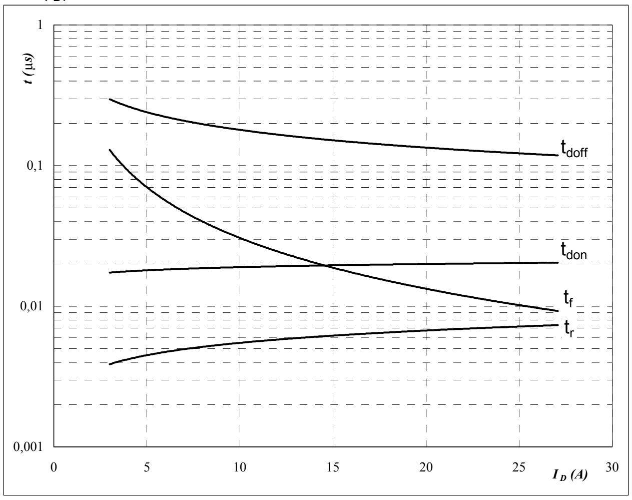
T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	+10/0	V
I_D =	27	A

INPUT BOOST

Figure 9 BOOST MOSFET

Typical switching times as a function of collector current

$t = f(I_D)$



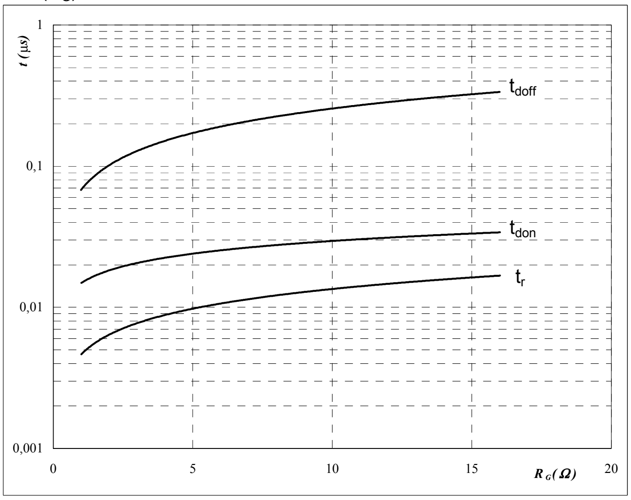
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	+10/0	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

Figure 10 BOOST MOSFET

Typical switching times as a function of gate resistor

$t = f(R_G)$



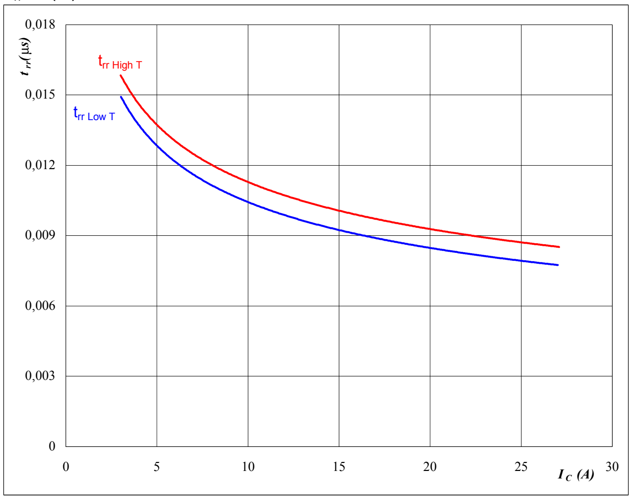
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	+10/0	V
I_C =	27	A

Figure 11 BOOST FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(Ic)$



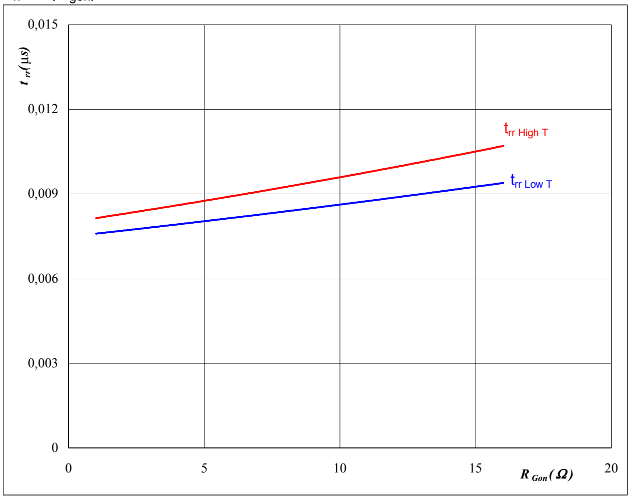
At

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	+10/0	V
R_{gon} =	4	Ω

Figure 12 BOOST FWD

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

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



At

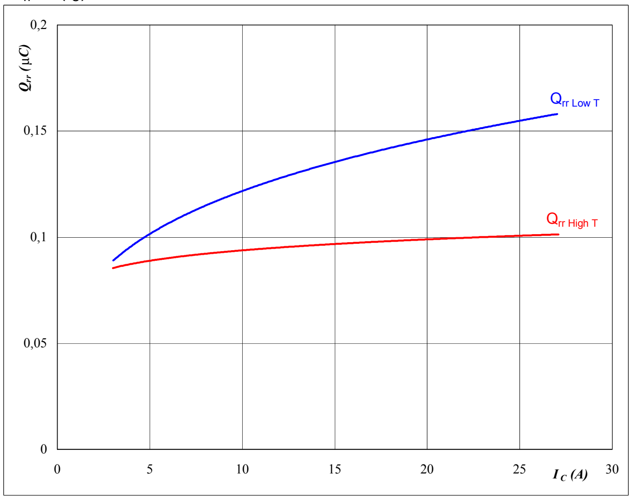
T_j =	25/125	°C
V_R =	400	V
I_F =	27	A
V_{GS} =	+10/0	V

INPUT BOOST

Figure 13 BOOST FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



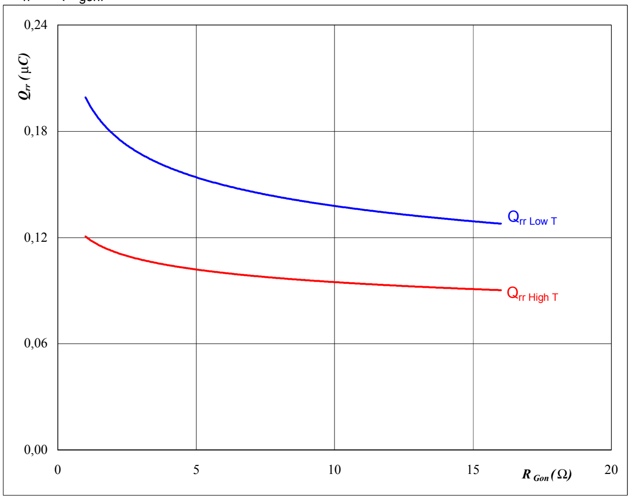
At

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	+10/0	V
R_{gon} =	4	Ω

Figure 14 BOOST FWD

Typical reverse recovery charge as a function of MOSFET turn on gate resistor

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



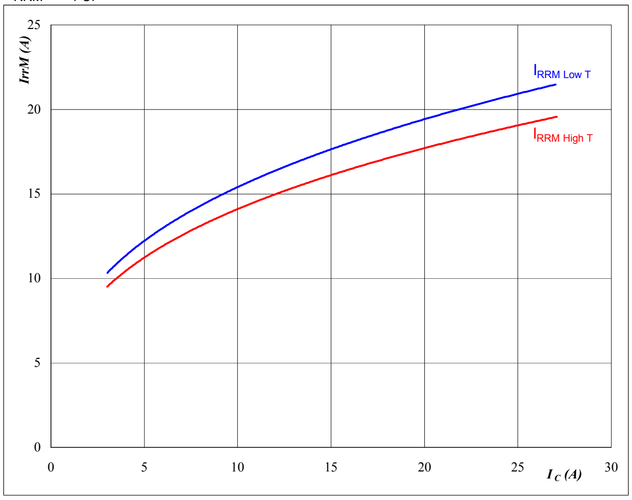
At

Tj =	25/125	°C
VR =	400	V
IF =	27	A
VGS =	+10/0	V

Figure 15 BOOST FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



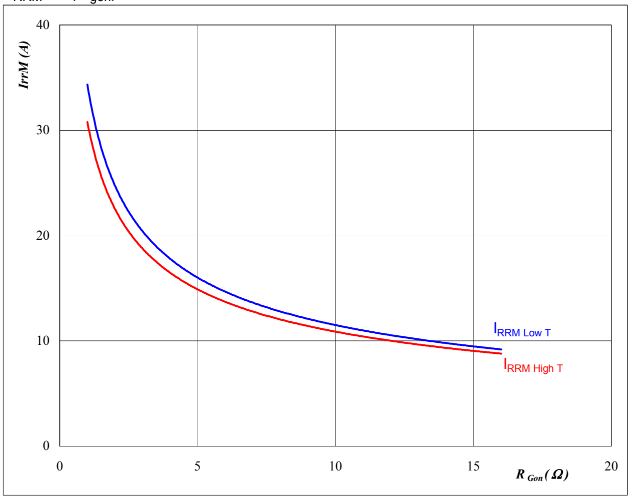
At

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	+10/0	V
R_{gon} =	4	Ω

Figure 16 BOOST FWD

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

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



At

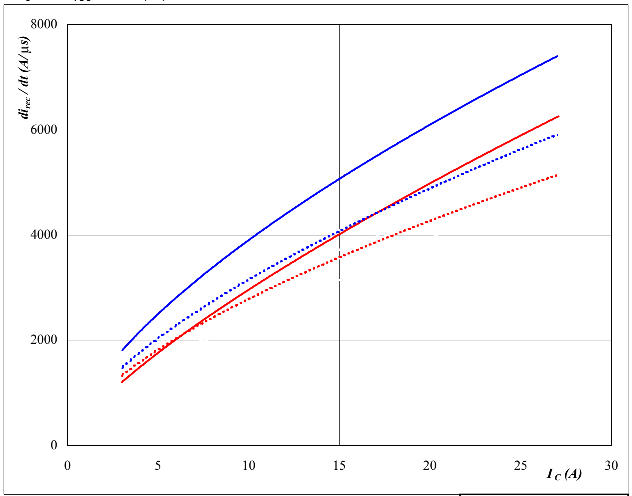
T_j =	25/125	°C
V_R =	400	V
I_F =	27	A
V_{GS} =	+10/0	V

INPUT BOOST

Figure 17 BOOST FWD

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

$dI_0/dt, dI_{rec}/dt = f(Ic)$



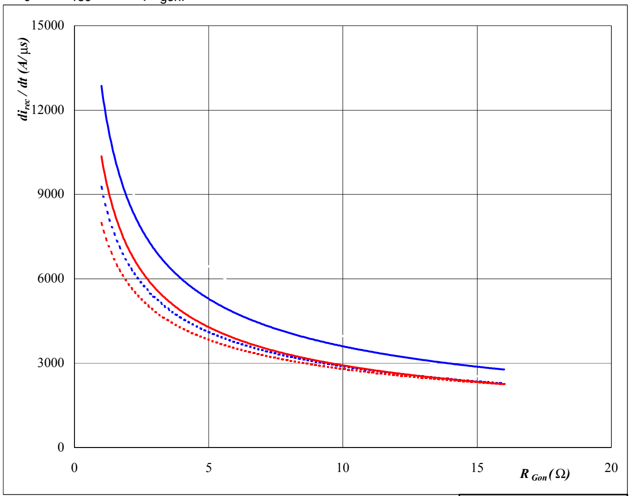
At

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	+10/0	V
R_{gon} =	4	Ω

Figure 18 BOOST FWD

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

$dI_0/dt, dI_{rec}/dt = f(R_{gon})$



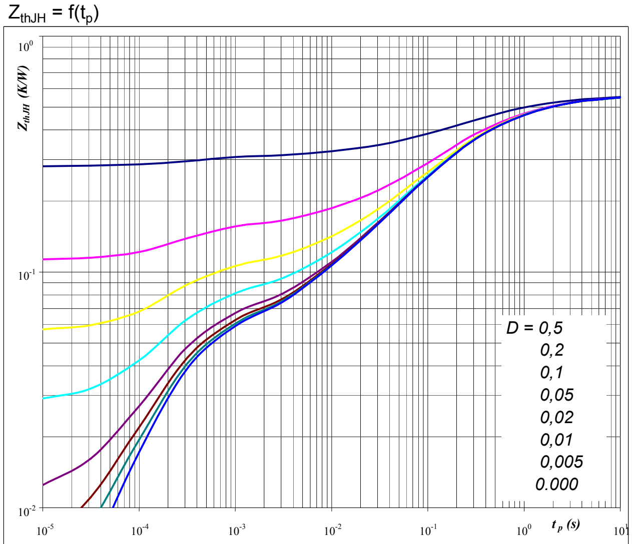
At

T_j =	25/125	°C
V_R =	400	V
I_F =	27	A
V_{GS} =	+10/0	V

Figure 19 BOOST MOSFET

MOSFET transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D = t_p / T

R_{thJH} = 0,56 K/W

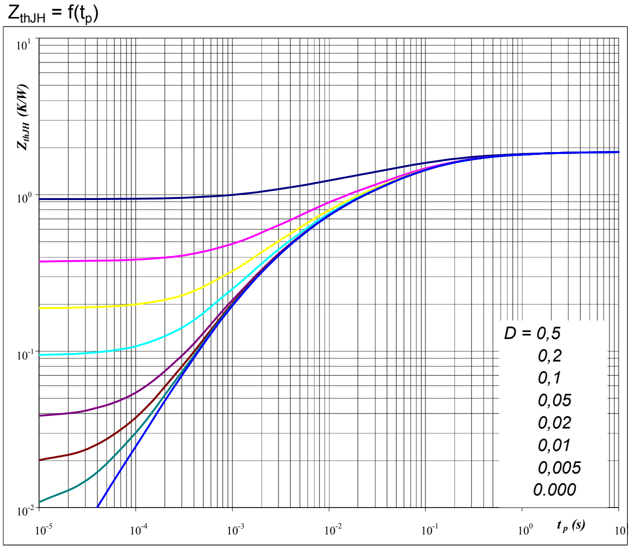
MOSFET thermal model values

R (C/W)	Tau (s)
0,036	8,58E+00
0,130	1,38E+00
0,229	2,24E-01
0,088	3,59E-02
0,026	4,98E-03
0,052	2,64E-04

Figure 20 BOOST FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D = t_p / T

R_{thJH} = 1,87 K/W

FWD thermal model values

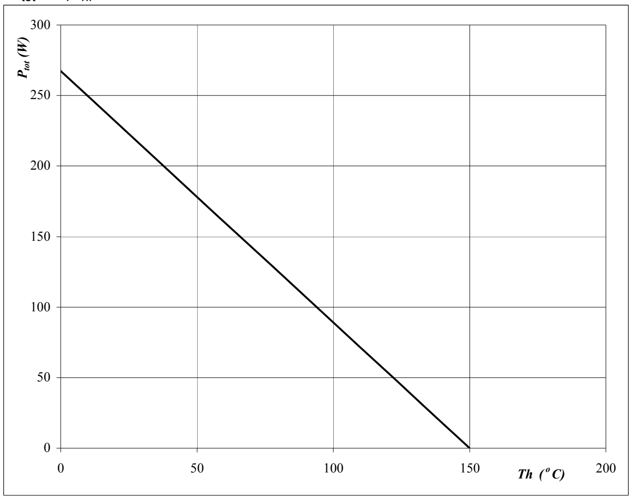
R (C/W)	Tau (s)
0,12	1,72E+00
0,48	1,77E-01
0,59	3,82E-02
0,49	6,29E-03
0,18	1,17E-03

INPUT BOOST

Figure 21 BOOST MOSFET

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



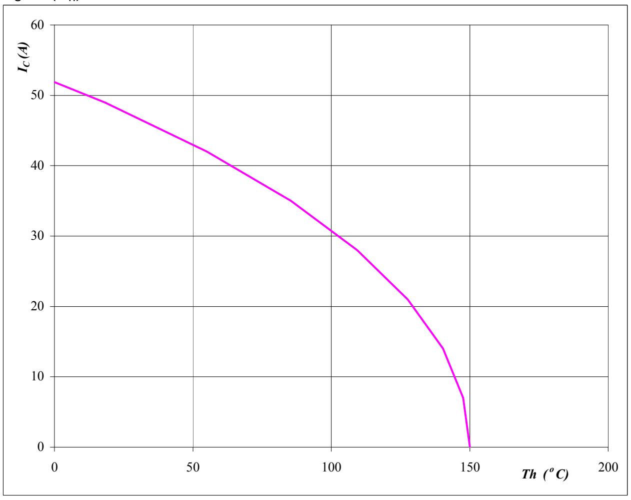
At

T_j = 150 °C

Figure 22 BOOST MOSFET

Collector/Drain current as a function of heatsink temperature

$I_C = f(T_h)$



At

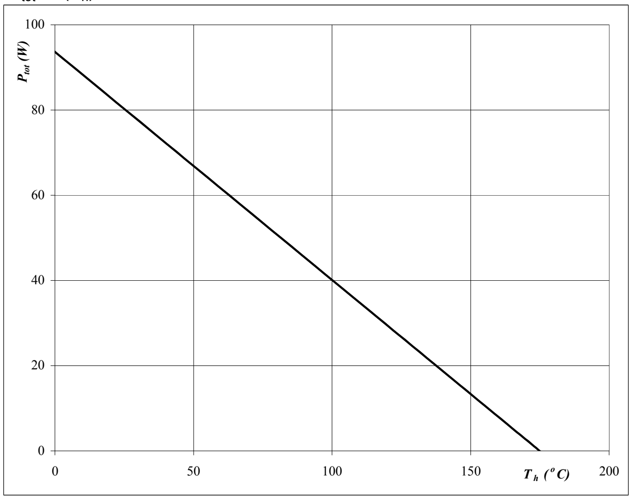
T_j = 150 °C

V_{GS} = 10 V

Figure 23 BOOST FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



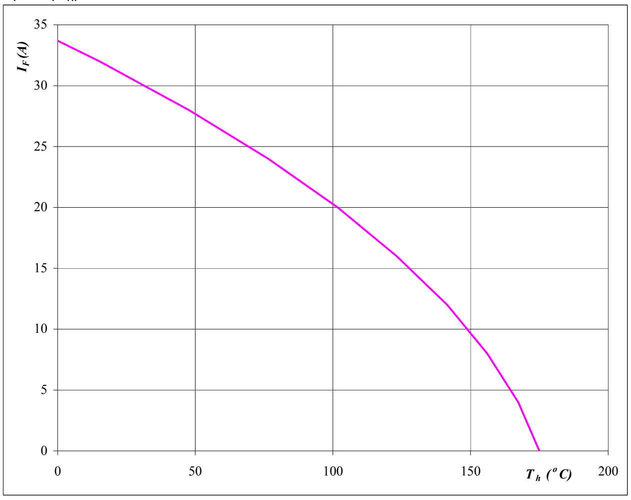
At

T_j = 175 °C

Figure 24 BOOST FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

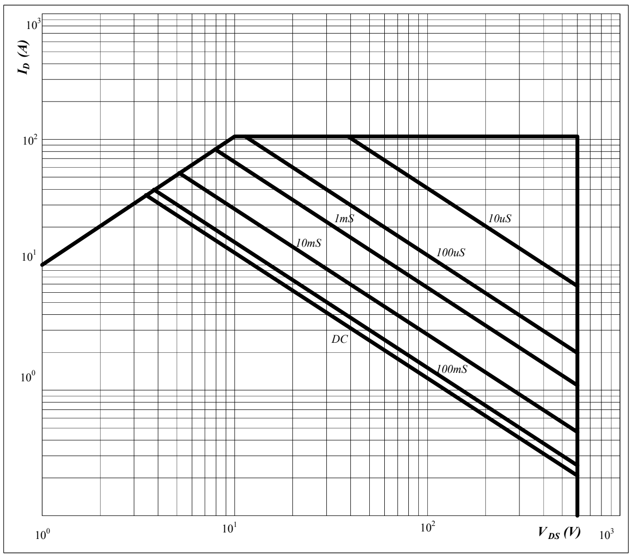
T_j = 175 °C

INPUT BOOST

Figure 25 BOOST MOSFET

Safe operating area as a function of drain-source voltage

$I_D = f(V_{DS})$



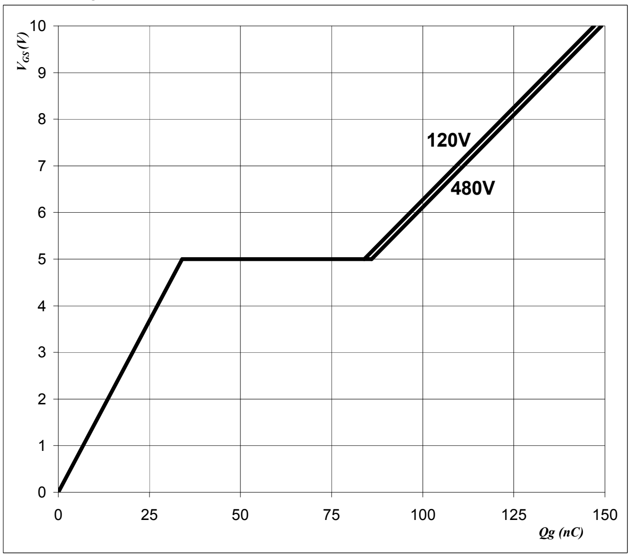
At

D =	single pulse	
T_h =	80	ºC
V_{GS} =	+10/0	V
T_j =	T_{jmax}	ºC

Figure 26 BOOST MOSFET

Gate voltage vs Gate charge

$V_{GS} = f(Qg)$



At

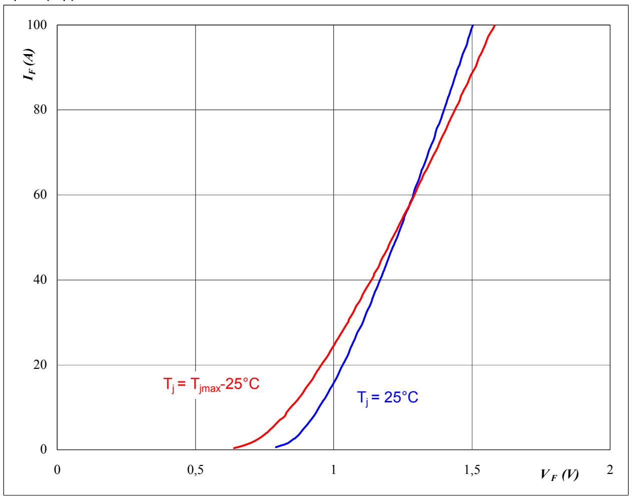
I_D =	44	A

Bypass Diode

Figure 1 Bypass diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



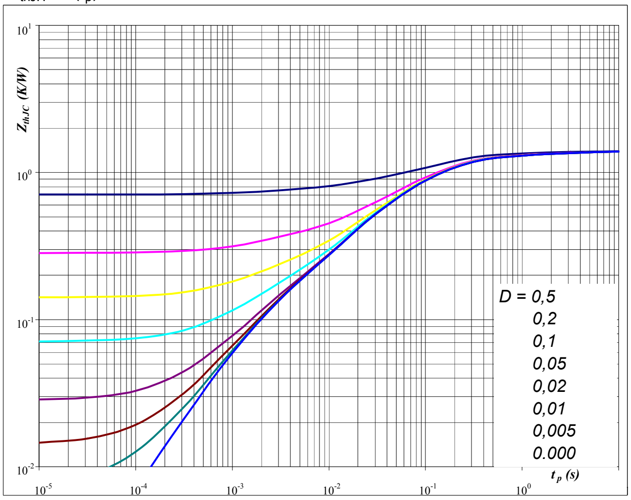
At

t_p = 250 µs

Figure 2 Bypass diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

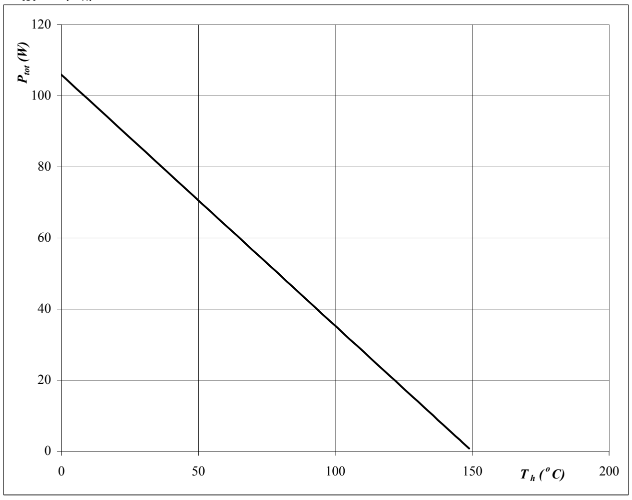
D = t_p / T

R_{thJH} = 1,42 K/W

Figure 3 Bypass diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



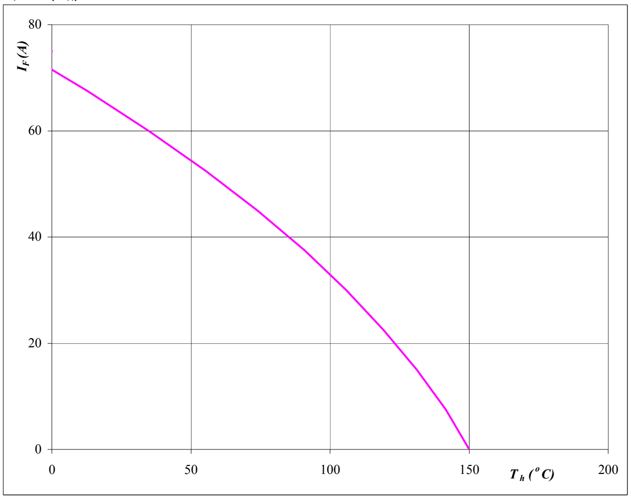
At

T_j = 150 ºC

Figure 4 Bypass diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

T_j = 150 ºC

Thermistor

Figure 1 Thermistor

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

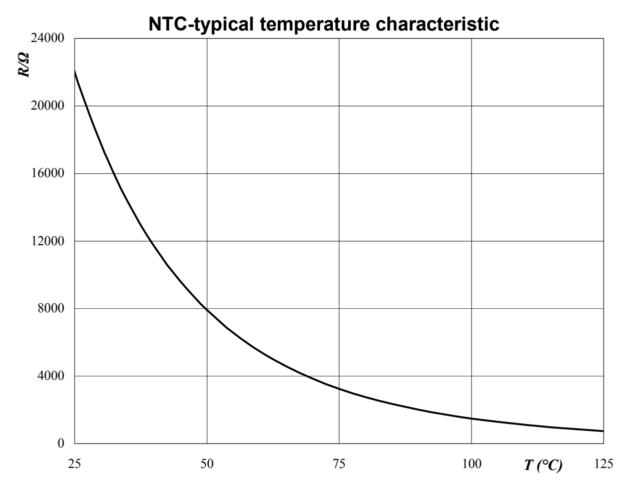


Figure 2 Thermistor

Typical NTC resistance values

$$R(T) = R_{25} \cdot e^{\left(B_{25/100} \cdot \left(\frac{1}{T} - \frac{1}{T_{25}}\right)\right)} \quad [\Omega]$$

T [°C]	R_{nom} [Ω]	R_{min} [Ω]	R_{max} [Ω]	△R/R [±%]
-55	2089434,5	1506495,4	2672373,6	27,9
0	71804,2	59724,4	83884	16,8
10	43780,4	37094,4	50466,5	15,3
20	27484,6	23684,6	31284,7	13,8
25	22000	19109,3	24890,7	13,1
30	17723,3	15512,2	19934,4	12,5
60	5467,9	4980,6	5955,1	8,9
70	3848,6	3546	4151,1	7,9
80	2757,7	2568,2	2947,1	6,9
90	2008,9	1889,7	2128,2	5,9
100	**1486,1**	**1411,8**	**1560,4**	**5**
150	400,2	364,8	435,7	8,8

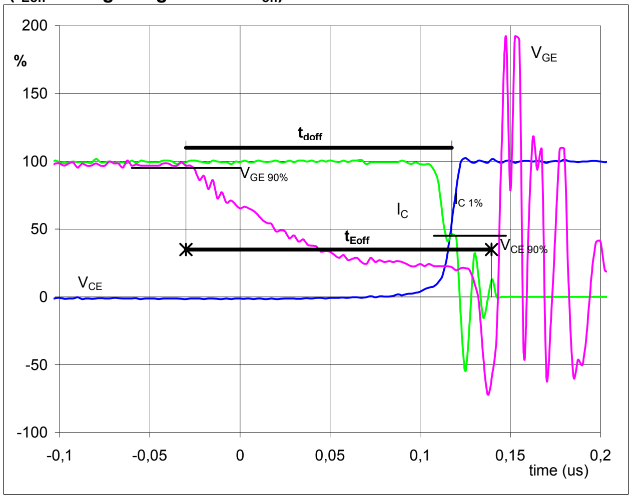
Switching Definitions Boost MOSFET

General conditions

T_j	=	125 °C
R_{gon}	=	4 Ω
R_{goff}	=	4 Ω

Figure 1 BOOST MOSFET

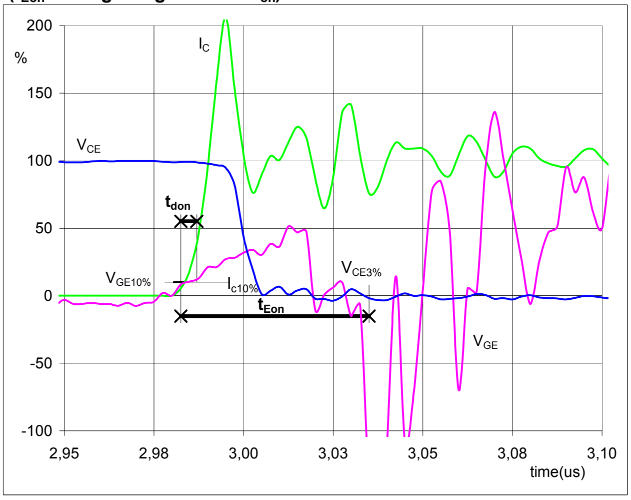
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	10	V
V_C (100%) =	400	V
I_C (100%) =	15	A
t_{doff} =	-0,48	μs
t_{Eoff} =	0,17	μs

Figure 2 BOOST MOSFET

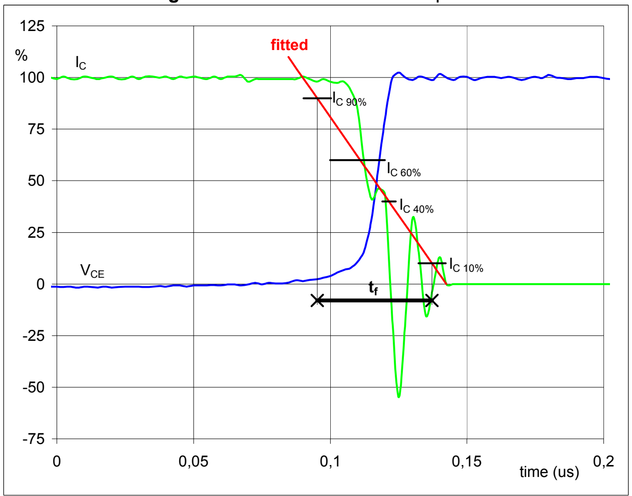
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	10	V
V_C (100%) =	400	V
I_C (100%) =	15	A
t_{don} =	0,02	μs
t_{Eon} =	0,05	μs

Figure 3 BOOST MOSFET

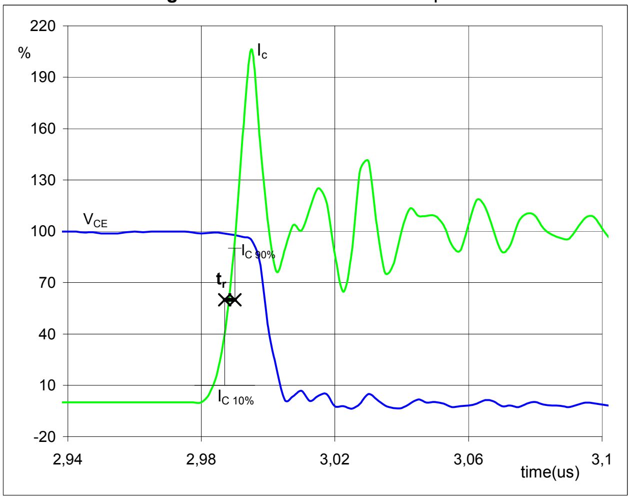
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	400	V
I_C (100%) =	15	A
t_f =	0,02	μs

Figure 4 BOOST MOSFET

Turn-on Switching Waveforms & definition of t_r

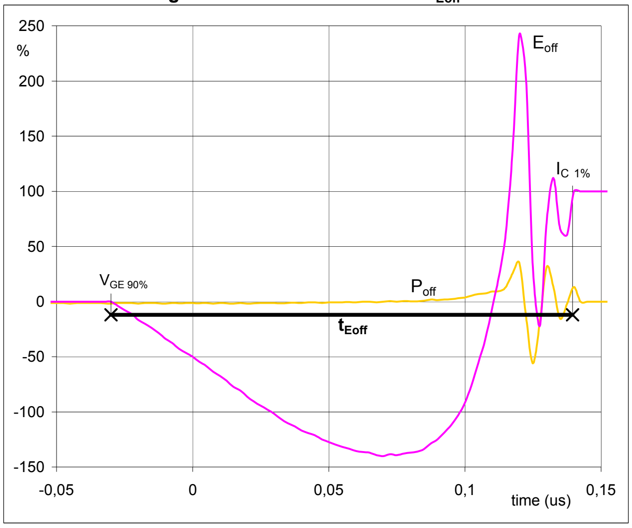


V_C (100%) =	400	V
I_C (100%) =	15	A
t_r =	0,01	μs

Switching Definitions Boost MOSFET

Figure 5 BOOST MOSFET

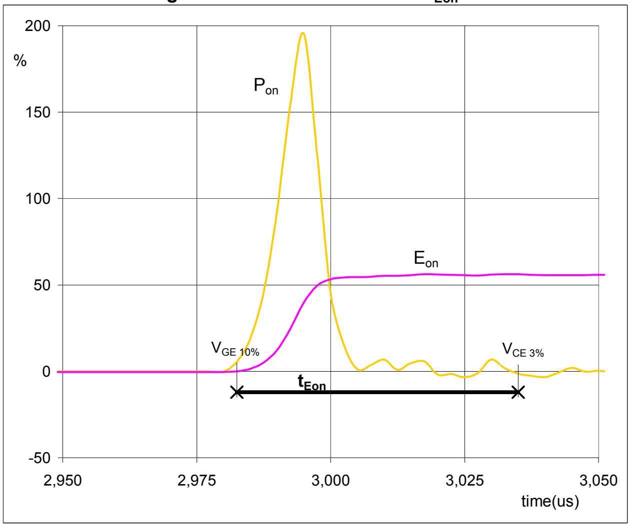
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	6,05	kW
E_{off} (100%) =	0,83	mJ
t_{Eoff} =	0,17	μs

Figure 6 BOOST MOSFET

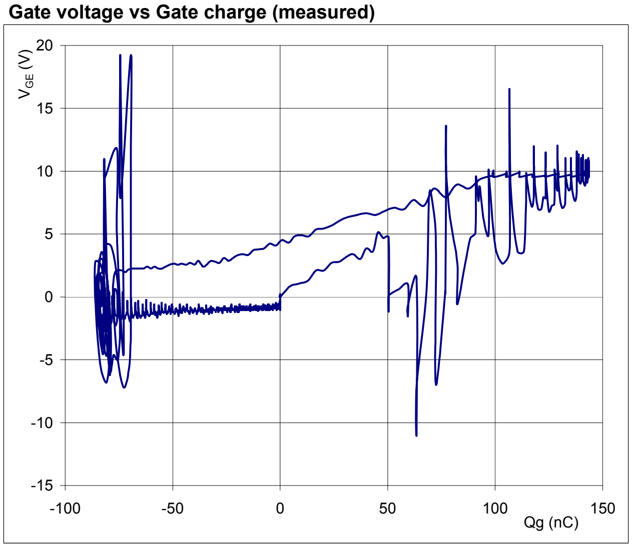
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	6,05	kW
E_{on} (100%) =	0,00	mJ
t_{Eon} =	0,05	μs

Figure 7 BOOST MOSFET

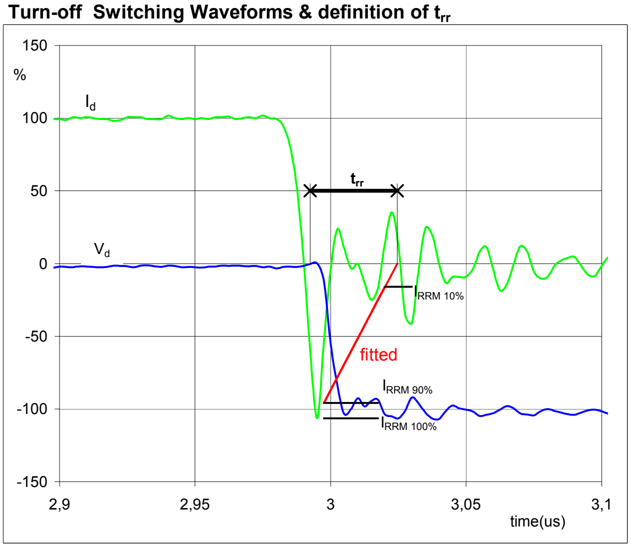
Gate voltage vs Gate charge (measured)



V_{GEoff} =	0	V
V_{GEon} =	10	V
V_C (100%) =	400	V
I_C (100%) =	15	A
Q_g =	143,53	nC

Figure 8 BOOST FWD

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

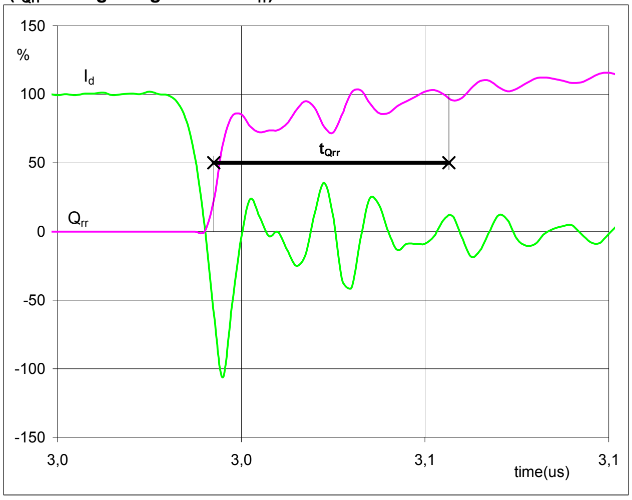


V_d (100%) =	400	V
I_d (100%) =	15	A
I_{RRM} (100%) =	-8	A
t_{rr} =	0,01	μs

Switching Definitions Boost MOSFET

Figure 9 BOOST FWD

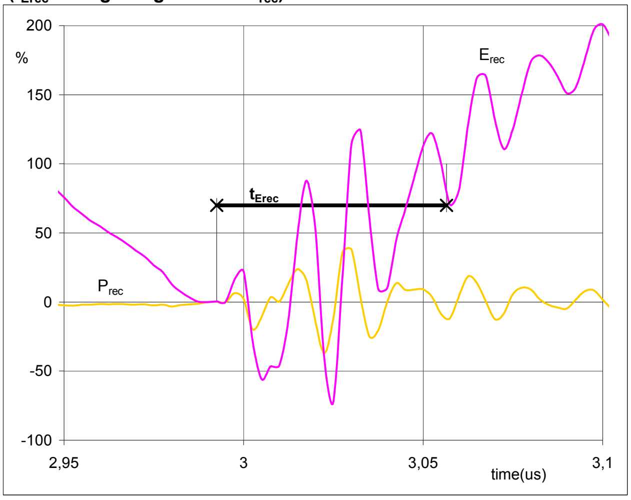
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	15	A
Q_{rr} (100%) =	0,06	μC
t_{Qrr} =	0,06	μs

Figure 10 BOOST FWD

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



P_{rec} (100%) =	6,05	kW
E_{rec} (100%) =	0,01	mJ
t_{Erec} =	0,06	μs

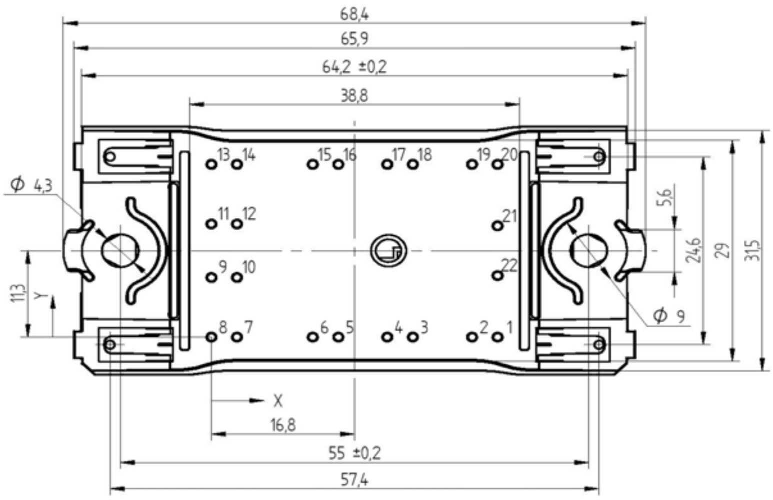
Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

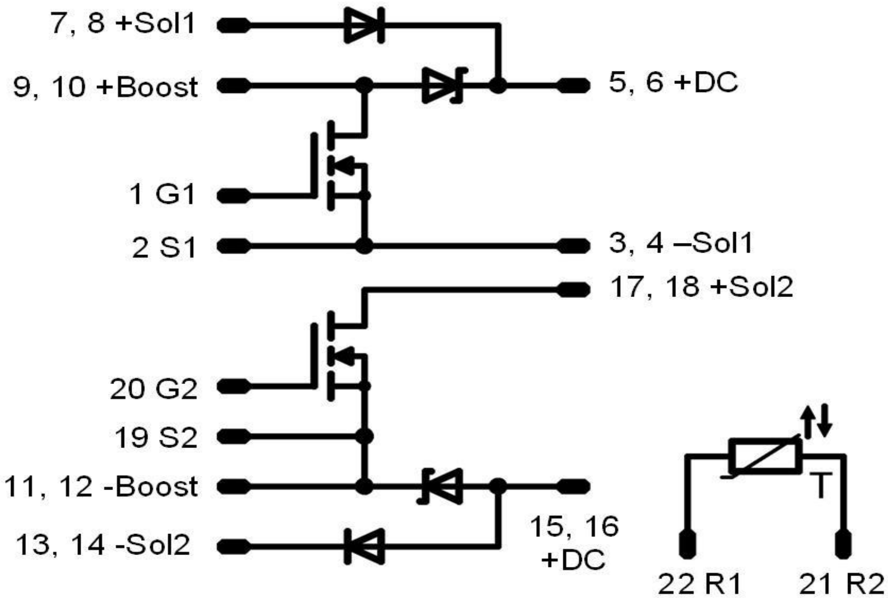
Version	Ordering Code	in DataMatrix as	in packaging barcode as
Standard in flow0 12mm housing	10-FZ06NBA045FH-P915L	P915L	P915L

Outline

Pin table		
Pin	X	Y
1	33,6	0
2	30,6	0
3	23,65	0
4	20,65	0
5	14,9	0
6	11,9	0
7	3	0
8	0	0
9	0	7,8
10	3	7,8
11	0	14,8
12	3	14,8
13	0	22,6
14	3	22,6
15	11,9	22,6
16	14,9	22,6
17	20,65	22,6
18	23,65	22,6
19	30,6	22,6
20	33,6	22,6
21	33,6	14,55
22	33,6	8,05



Pinout



PRODUCT STATUS DEFINITIONS

Datasheet Status	Product Status	Definition
Target	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice. The data contained is exclusively intended for technically trained staff.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data may be published at a later date. Vincotech reserves the right to make changes at any time without notice in order to improve design. The data contained is exclusively intended for technically trained staff.
Final	Full Production	This datasheet contains final specifications. Vincotech reserves the right to make changes at any time without notice in order to improve design. The data contained is exclusively intended for technically trained staff.

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