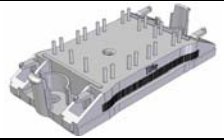
flowBOOST0 600V/41mΩ

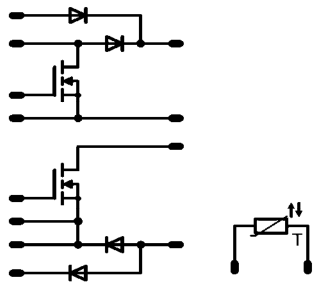
Features
- High efficiency symmetric boost
- Ultrafast switching frequency with MOSFET
- Low Inductance Layout
- Tandem to NPC and MNPC modules

flow0 12mm housing



Target Applications
- Solar inverters
- UPS

Schematic



Types
- 10-FZ06NBA041FS01-P915L78

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	42 57	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	32 39	A
Pulsed drain current	I_{Dpulse}	t_p limited by $T_j$max		272	A
Power dissipation	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	97 147	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 Diode					
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25°C		600	V
Non DC forward current	I_F	T_j=$T_j$max	T_h=80°C T_c=80°C	29 38	A
Non-Repetitive peak forward current	I_{FSM}	t_p limited by $T_j$max		300	A
Power dissipation	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	42 64	W
Maximum Junction Temperature	$T_j$max			150	°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				35	Tj=25°C Tj=125°C	0,8	0,99 0,91	1,3	V
Threshold voltage (for power loss calc. only)	V_{to}				35	Tj=25°C Tj=125°C		0,87 0,74		V
Slope resistance (for power loss calc. only)	r_t				35	Tj=25°C Tj=125°C		0,008 0,011		Ω
Reverse current	I_r			1600		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	$R_{DS(on)}$		10		44,4	Tj=25°C Tj=125°C		0,040 0,079		Ω
Gate threshold voltage	$V_{(GS)th}$	VGS=VDS			0,00296	Tj=25°C Tj=125°C	2,4	3	3,6	V
Gate to Source Leakage Current	I_{gss}		0	600		Tj=25°C Tj=125°C			100	nA
Zero Gate Voltage Drain Current	I_{dss}		20	0		Tj=25°C Tj=125°C			5	µA
Turn On Delay Time	$t_{d(ON)}$	Rgoff=8 Ω Rgon=8 Ω	10/0	400	15	Tj=25°C Tj=125°C		35 33		ns
Rise Time	t_r					Tj=25°C Tj=125°C		9 10		
Turn off delay time	$t_{d(OFF)}$					Tj=25°C Tj=125°C		275 300		
Fall time	t_f					Tj=25°C Tj=125°C		4 5		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=125°C		0,18 0,34		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=125°C		0,07 0,08		
Total gate charge	Q_g	Rgon=8 Ω	10	480	44	Tj=25°C Tj=125°C		290		nC
Gate to source charge	Q_{gs}					Tj=25°C Tj=125°C		36		
Gate to drain charge	Q_{gd}					Tj=25°C Tj=125°C		150		
Input capacitance	C_{iss}	f=1MHz	0	100		Tj=25°C		6530		pF
Output capacitance	C_{oss}							360		
Reverse transfer capacitance	C_{rss}							tbd.		
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						0,72		K/W
Input Boost Diode										
Forward voltage	V_F				30	Tj=25°C Tj=125°C	1,7	2,11 1,59	2,7	V
Reverse leakage current	I_{rm}		10/0	400		Tj=25°C Tj=125°C			100	µA
Peak recovery current	I_{RRM}	Rgon=8 Ω	10/0	400	15	Tj=25°C Tj=125°C		18 30		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=125°C		14 32		ns
Reverse recovery charge	Q_{rr}					Tj=25°C Tj=125°C		0,15 0,56		µC
Reverse recovered energy	E_{rec}					Tj=25°C Tj=125°C		0,02 0,07		mWs
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=125°C		5321 1723		A/µs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,67		K/W
Thermistor										
Rated resistance*	R_{25}	Tol. ±5%				Tj=25°C	20,9	22	23,1	kΩ
	R_{100}							1486		Ω
Power dissipation	P					Tj=25°C		200		mW
B-value	$B_{(25/100)}$	Tol. ±3%				Tj=25°C		3950		K

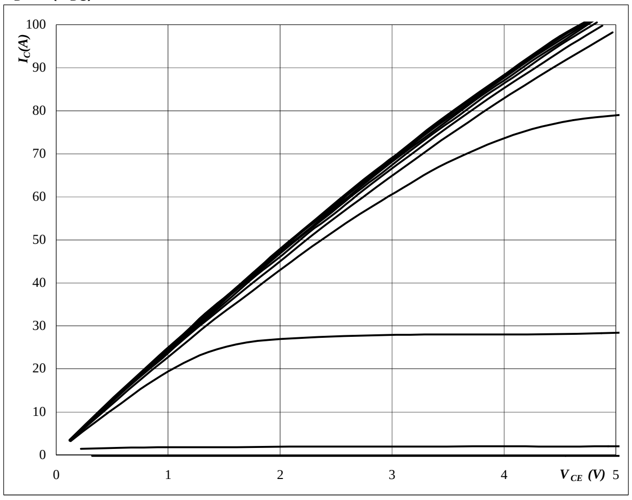
* see details on **Thermistor** charts on **Figure 2.**

INPUT BOOST

Figure 1 BOOST MOSFET

Typical output characteristics

$I_D = f(V_{DS})$



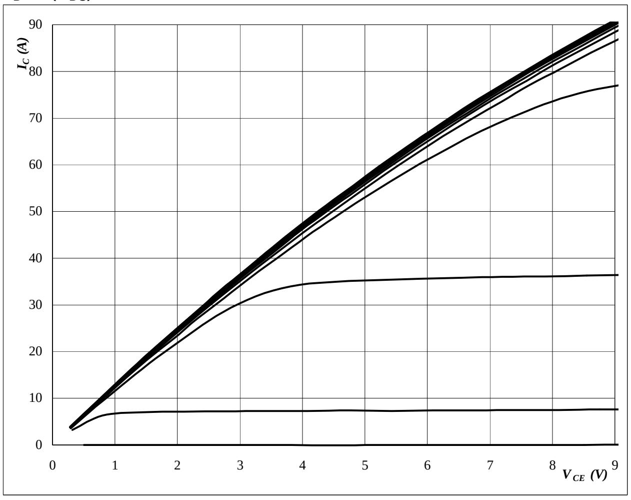
At

t_p =	250	μs
T_j =	25	°C
V_{DS} from	3 V to 13 V in steps of 1 V	

Figure 2 BOOST MOSFET

Typical output characteristics

$I_D = f(V_{DS})$



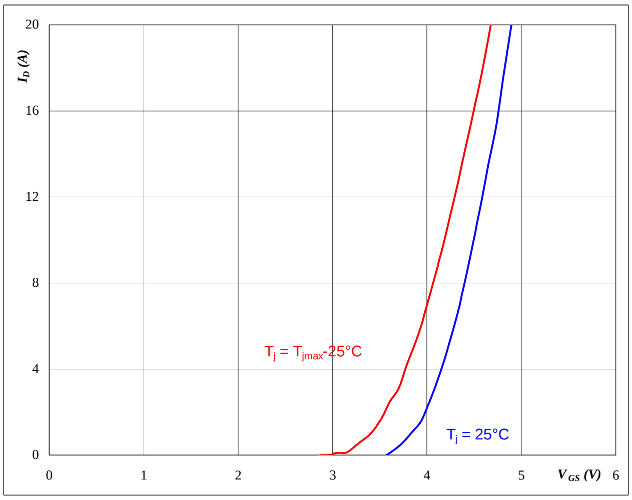
At

t_p =	250	μs
T_j =	125	°C
V_{DS} from	3 V to 13 V in steps of 1 V	

Figure 3 BOOST MOSFET

Typical transfer characteristics

$I_D = f(V_{DS})$



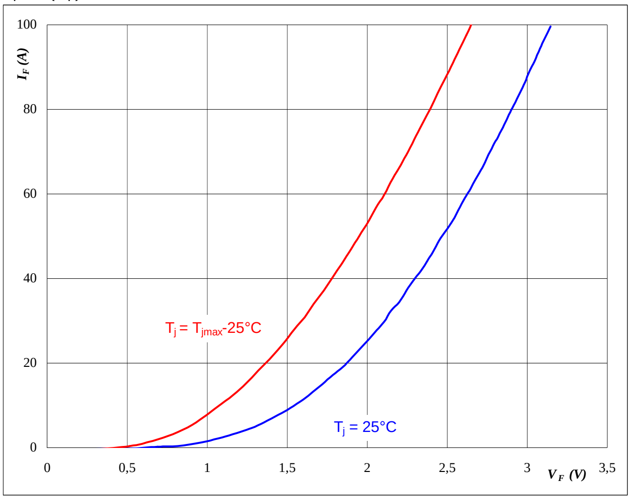
At

t_p =	250	μs
V_{DS} =	10	V

Figure 4 BOOST FWD

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



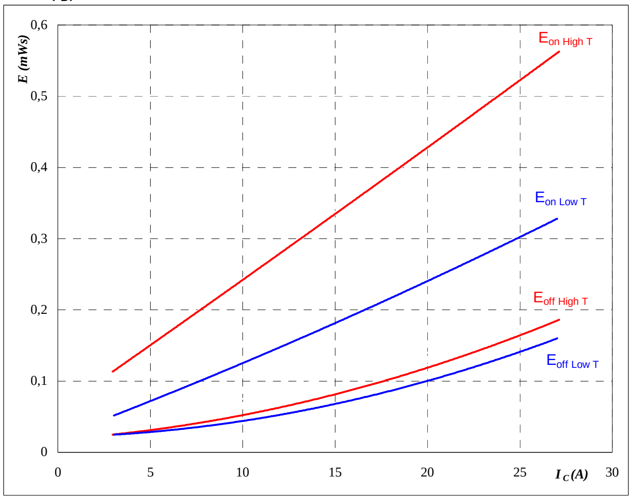
At

t_p =	250	μs

INPUT BOOST

Figure 5 BOOST MOSFET

Typical switching energy losses
as a function of collector current
$E = f(I_D)$

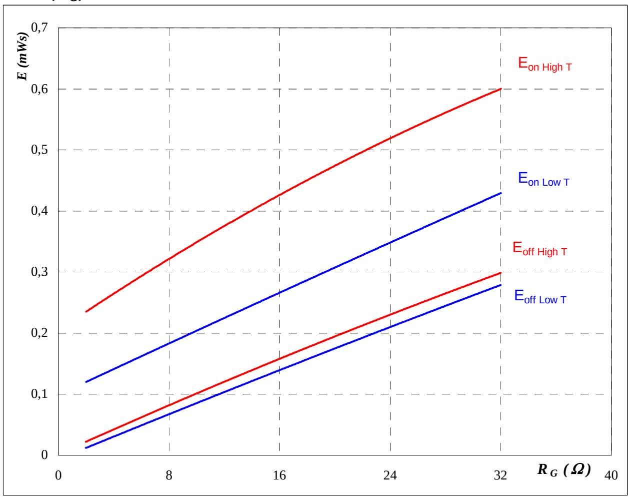


With an inductive load at

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	+10/0	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 6 BOOST MOSFET

Typical switching energy losses
as a function of gate resistor
$E = f(R_G)$

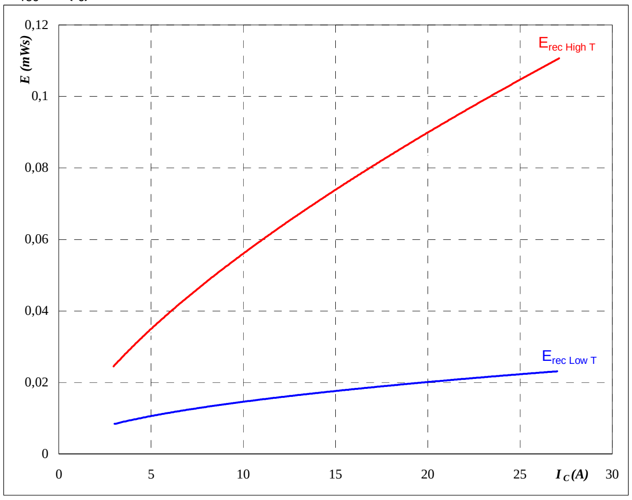


With an inductive load at

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	+10/0	V
I_D =	15	A

Figure 7 BOOST MOSFET

Typical reverse recovery energy loss
as a function of collector (drain) current
$E_{rec} = f(I_c)$

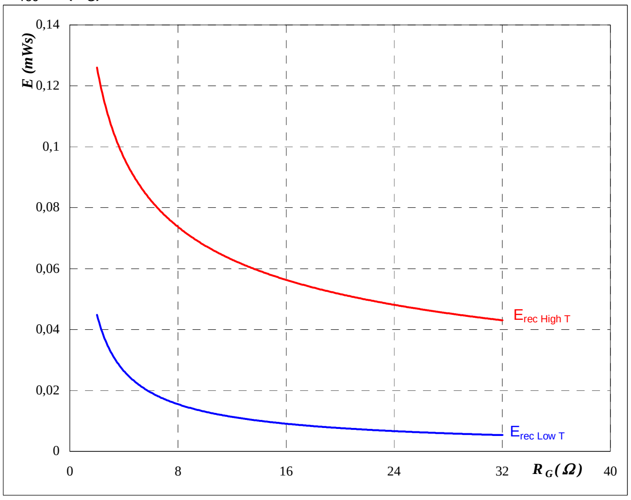


With an inductive load at

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	+10/0	V
R_{gon} =	8	Ω
R_{goff} =	8	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

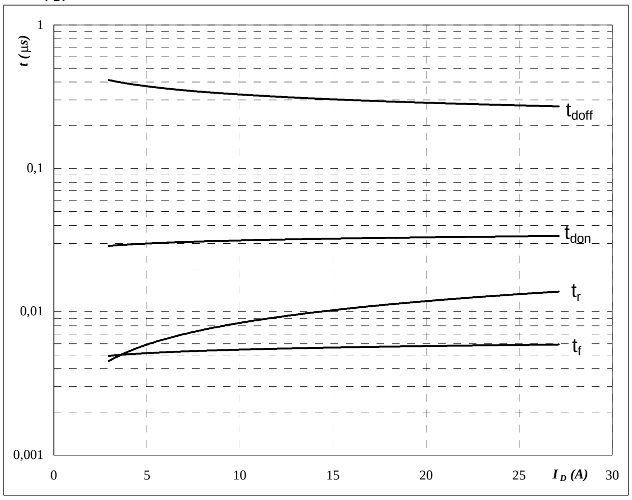
T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	+10/0	V
I_D =	15	A

INPUT BOOST

Figure 9 BOOST MOSFET

Typical switching times as a function of collector current

$t = f(I_D)$



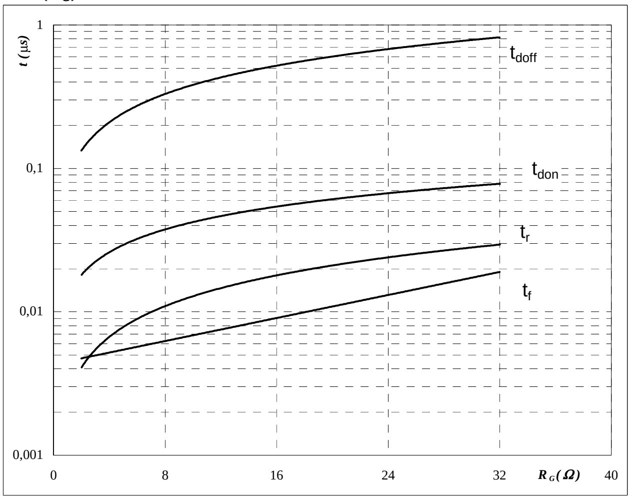
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	+10/0	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 10 BOOST MOSFET

Typical switching times as a function of gate resistor

$t = f(R_G)$



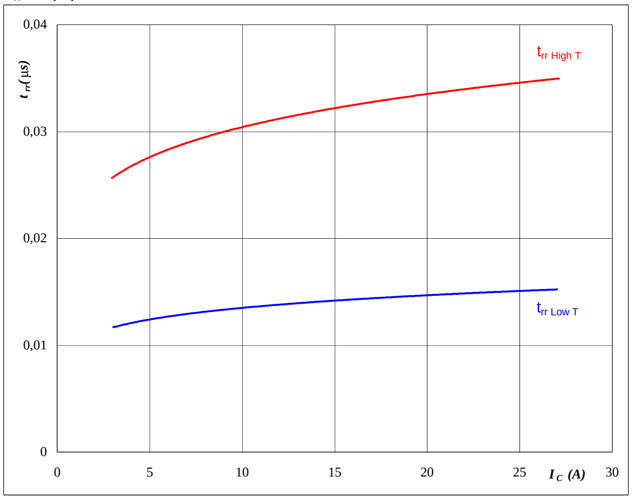
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	+10/0	V
I_C =	15	A

Figure 11 BOOST FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(Ic)$



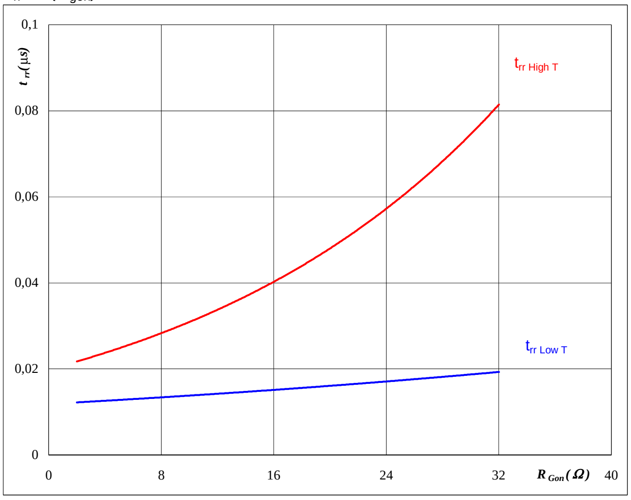
At

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	+10/0	V
R_{gon} =	8	Ω

Figure 12 BOOST FWD

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

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



At

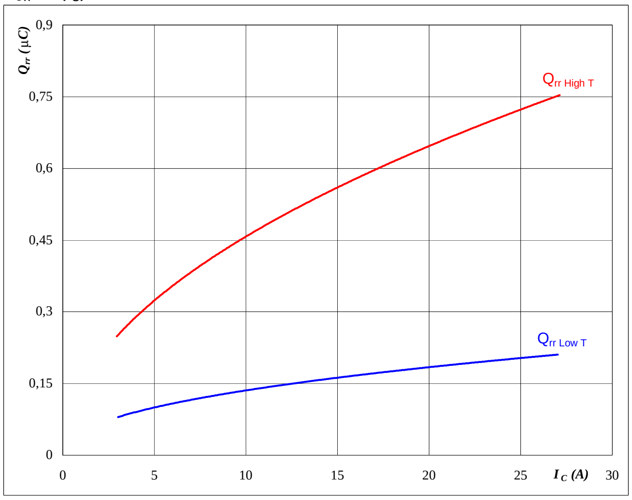
T_j =	25/125	°C
V_R =	400	V
I_F =	15	A
V_{GS} =	+10/0	V

INPUT BOOST

Figure 13 BOOST FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



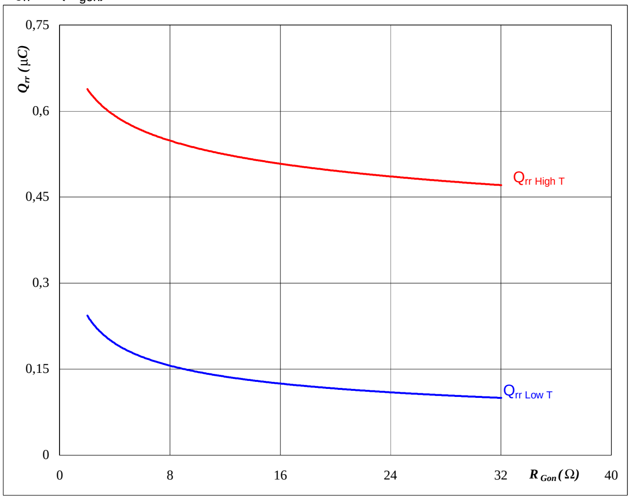
At

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	+10/0	V
R_{gon} =	8	Ω

Figure 14 BOOST FWD

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

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



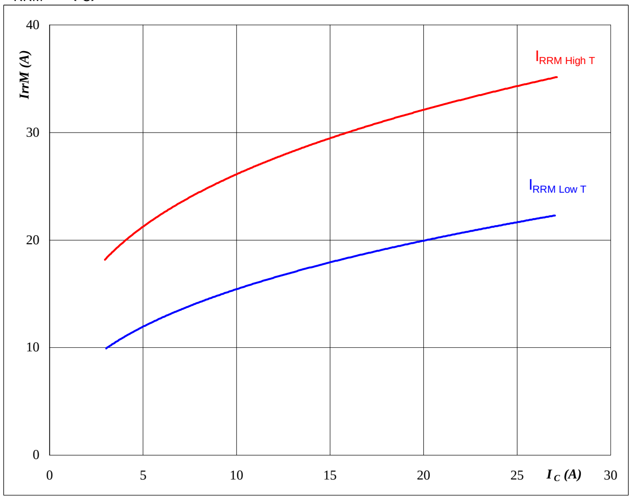
At

Tj =	25/125	°C
V_R =	400	V
I_F =	15	A
V_{GS} =	+10/0	V

Figure 15 BOOST FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



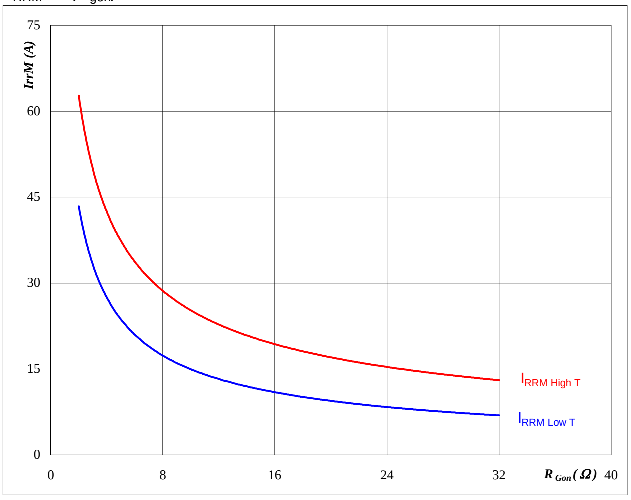
At

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	+10/0	V
R_{gon} =	8	Ω

Figure 16 BOOST FWD

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

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



At

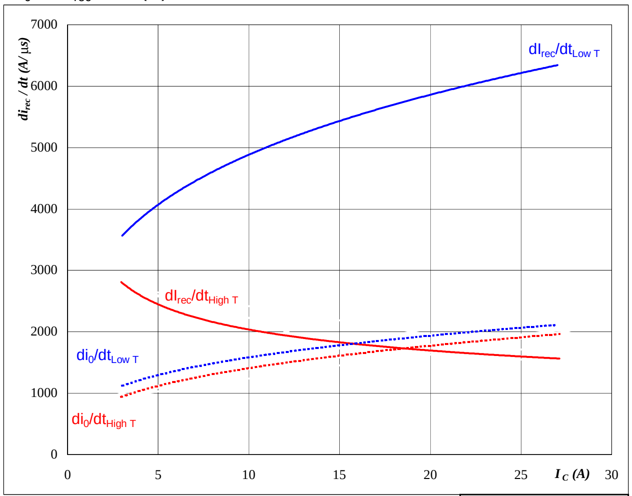
T_j =	25/125	°C
V_R =	400	V
I_F =	15	A
V_{GS} =	+10/0	V

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

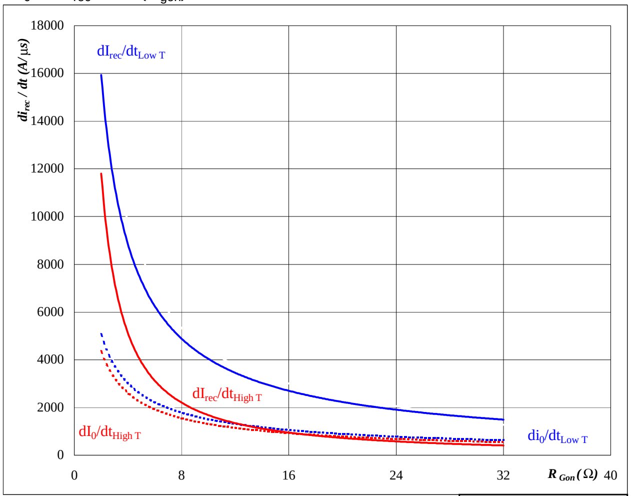
T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	+10/0	V
R_{gon} =	8	Ω

dI_0/dt
dI_{rec}/dt

Figure 18 BOOST FWD

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

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



At

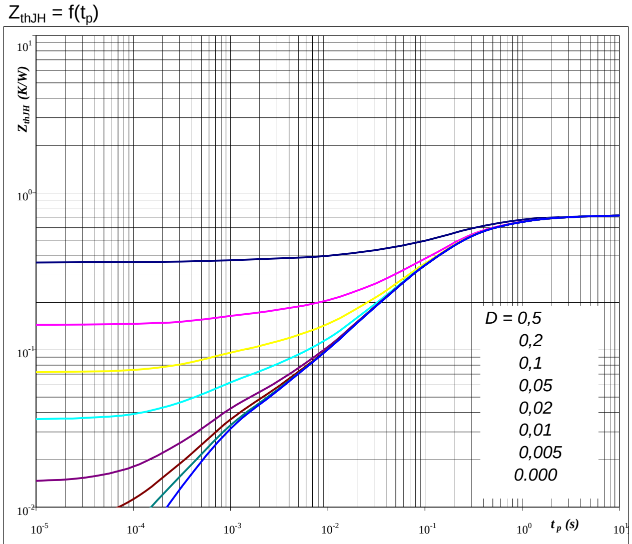
T_j =	25/125	°C
V_R =	400	V
I_F =	15	A
V_{GS} =	+10/0	V

dI_0/dt
dI_{rec}/dt

Figure 19 BOOST MOSFET

MOSFET transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

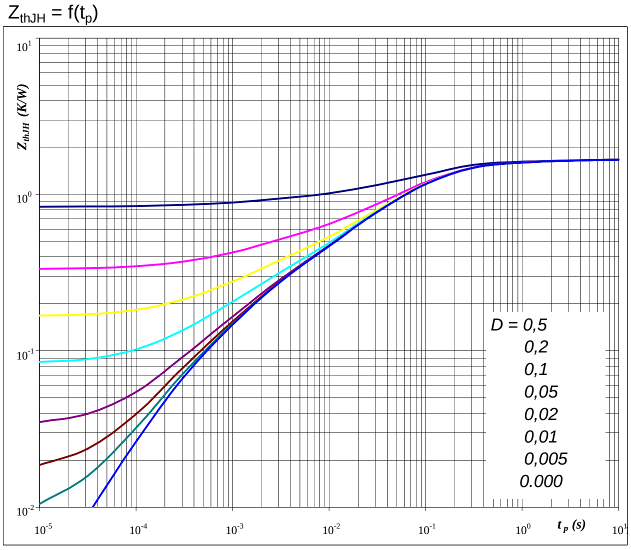
D =	t_p / T		
R_{thJH} =	0,72	K/W	IGBT thermal model values

R (C/W)	Tau (s)
0,019	8,77E+00
0,106	1,31E+00
0,352	2,19E-01
0,164	6,50E-02
0,049	1,06E-02
0,031	7,41E-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} =	1,67	K/W	FWD thermal model values

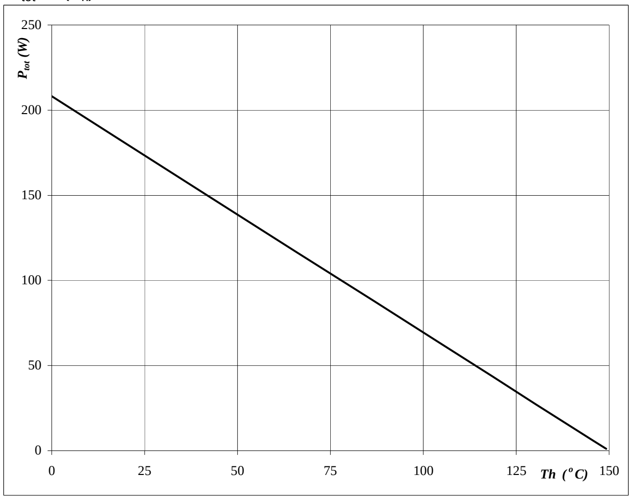
R (C/W)	Tau (s)
0,06	3,60E+00
0,24	4,21E-01
0,84	8,48E-02
0,32	1,50E-02
0,17	1,83E-03

INPUT BOOST

Figure 21 BOOST MOSFET

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



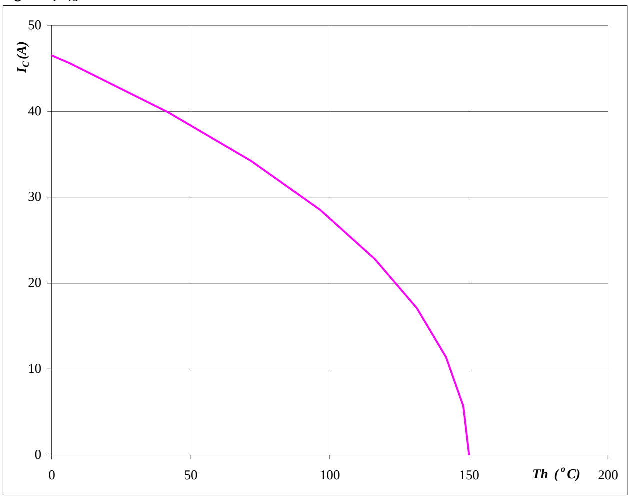
At

T_j =	150	ºC

Figure 22 BOOST MOSFET

Collector/Drain current as a function of heatsink temperature

$I_C = f(T_h)$



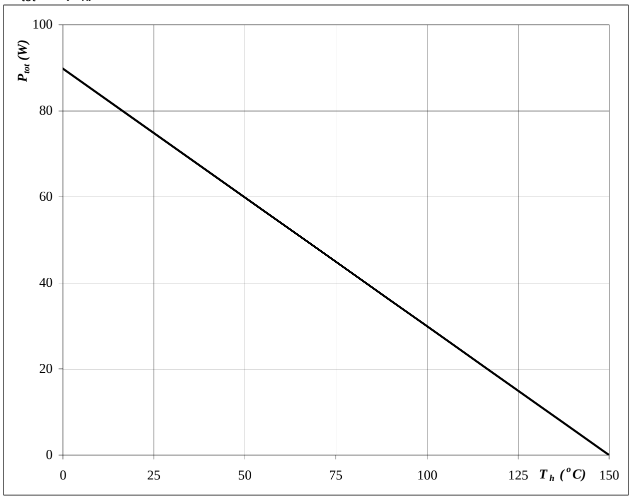
At

T_j =	150	ºC
V_{GS} =	10	V

Figure 23 BOOST FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



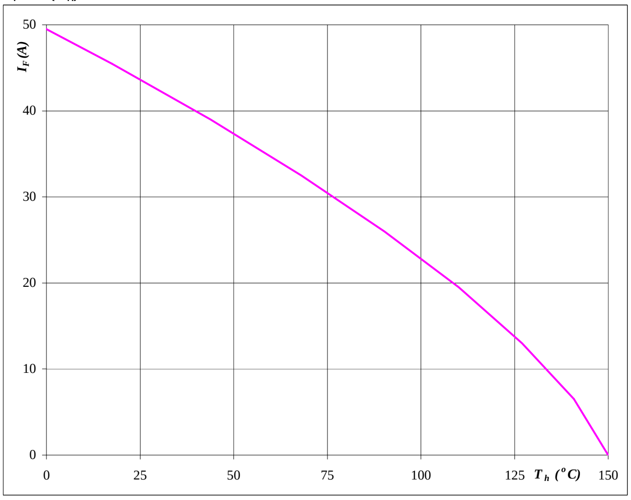
At

T_j =	150	ºC

Figure 24 BOOST FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

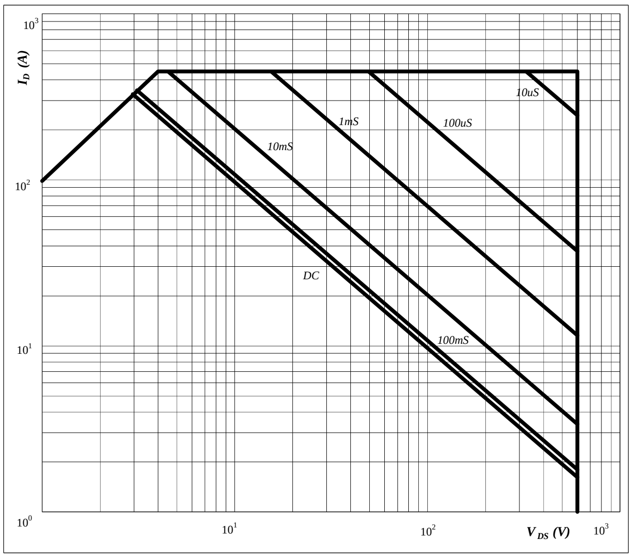
T_j =	150	ºC

INPUT BOOST

Figure 25	BOOST MOSFET

Safe operating area as a function of drain-source voltage

$I_D = f(V_{DS})$



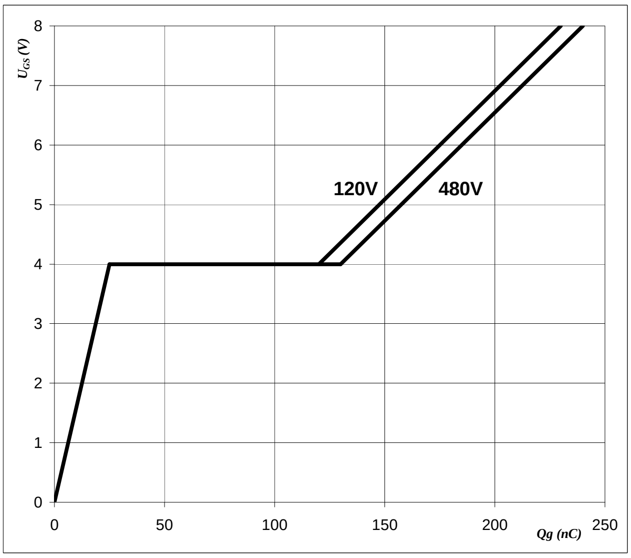
At

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

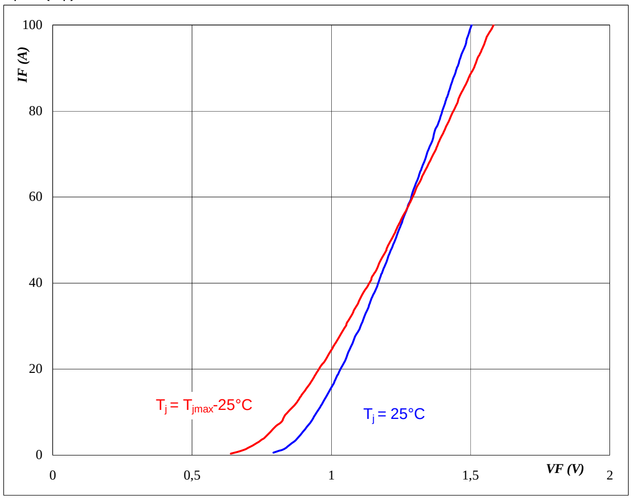
I_D =	15	A

Bypass Diode

Figure 1 Bypass diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



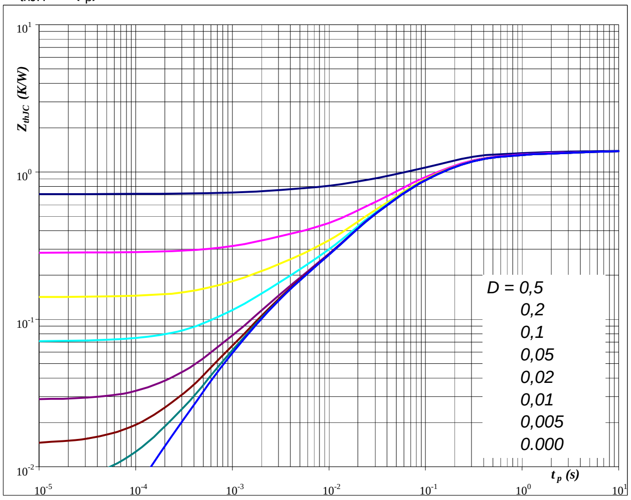
At

t_p =	250	μs

Figure 2 Bypass diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



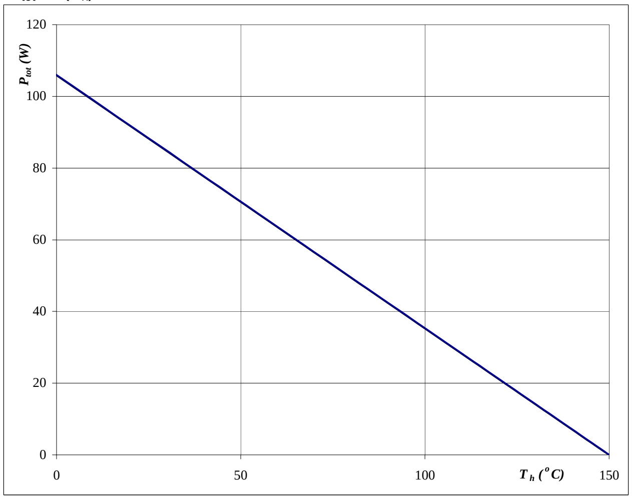
At

D =	t_p / T	
R_{thJH} =	1,42	K/W

Figure 3 Bypass diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



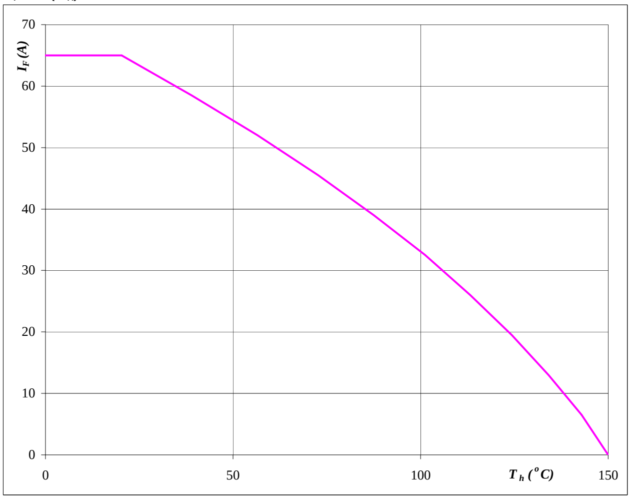
At

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
$R_T = f(T)$

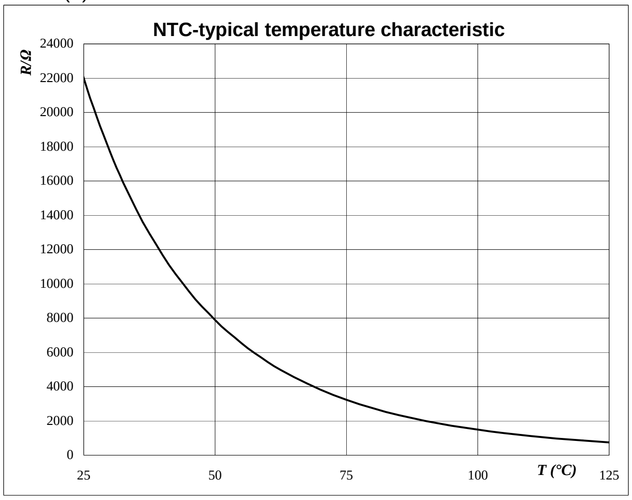


Figure 2 Thermistor

Typical NTC resistance values

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

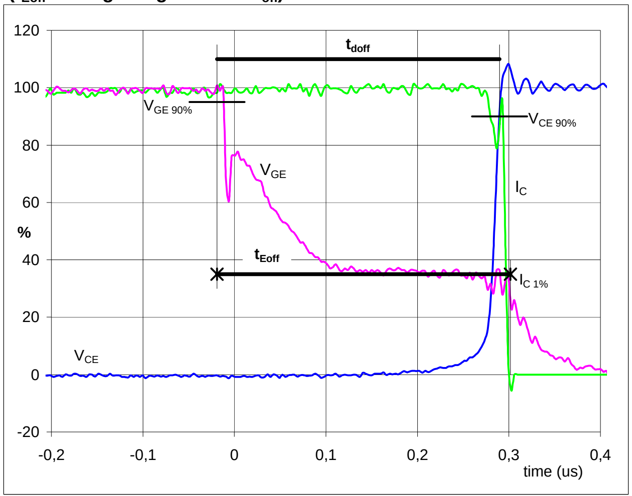
Switching Definitions Boost IGBT

General conditions

T_j	=	125 °C
R_{gon}	=	8 Ω
R_{goff}	=	8 Ω

Figure 1 BOOST IGBT

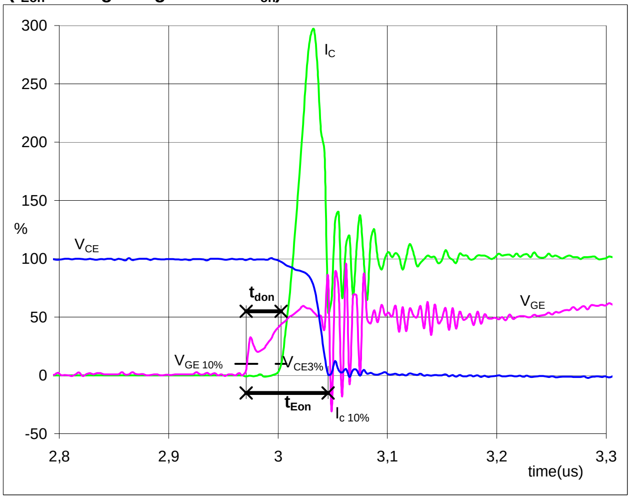
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	10	V
V_C (100%) =	400	V
I_C (100%) =	15	A
t_{doff} =	0,30	µs
t_{Eoff} =	0,32	µs

Figure 2 BOOST IGBT

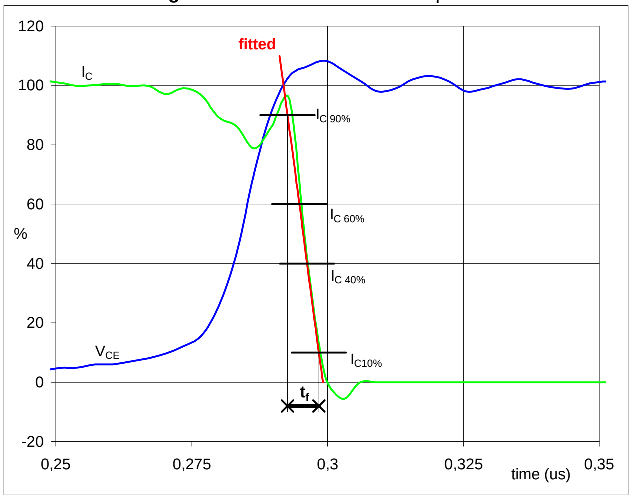
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	10	V
V_C (100%) =	400	V
I_C (100%) =	15	A
t_{don} =	0,03	µs
t_{Eon} =	0,07	µs

Figure 3 BOOST IGBT

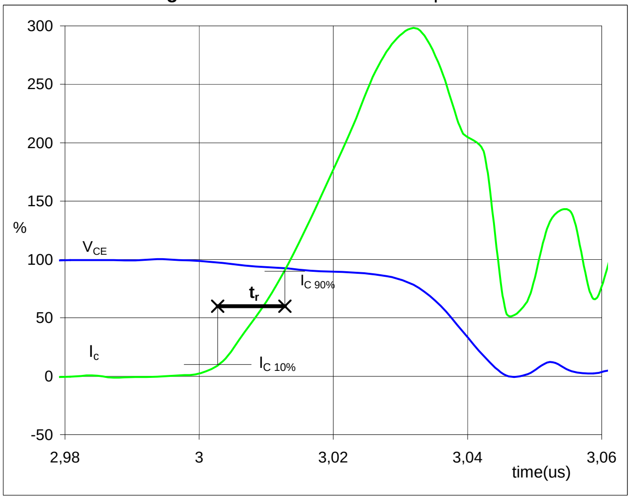
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	400	V
I_C (100%) =	15	A
t_f =	0,0040	µs

Figure 4 BOOST IGBT

Turn-on Switching Waveforms & definition of t_r

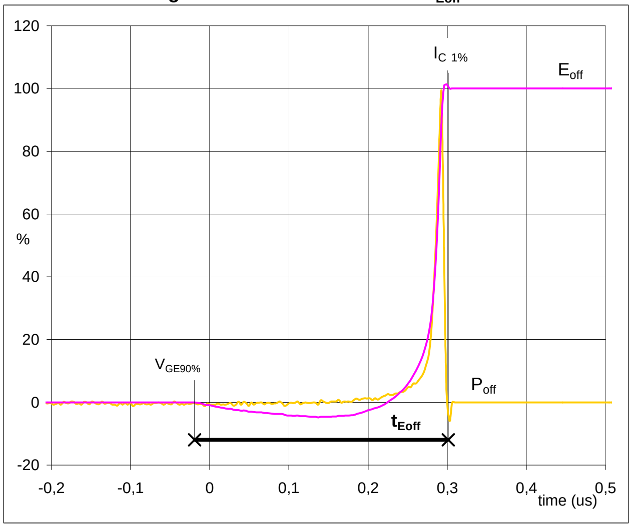


V_C (100%) =	400	V
I_C (100%) =	15	A
t_r =	0,01	µs

Switching Definitions Boost IGBT

Figure 5 BOOST IGBT

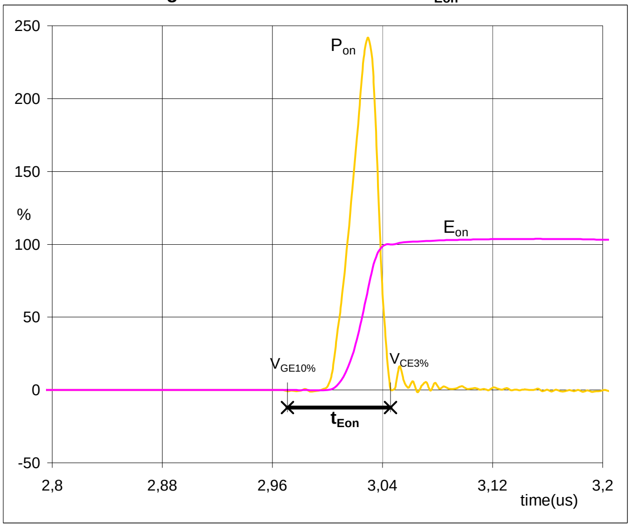
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	6,02	kW
E_{off} (100%) =	0,08	mJ
t_{Eoff} =	0,32	μs

Figure 6 BOOST IGBT

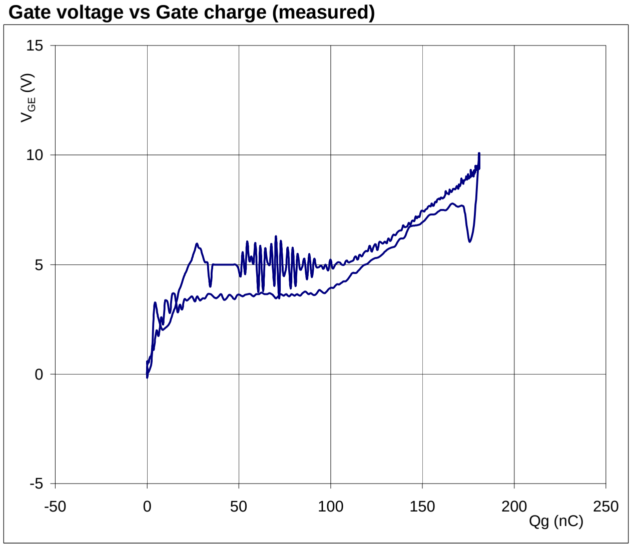
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	6,02	kW
E_{on} (100%) =	0,34	mJ
t_{Eon} =	0,07	μs

Figure 7 BOOST IGBT

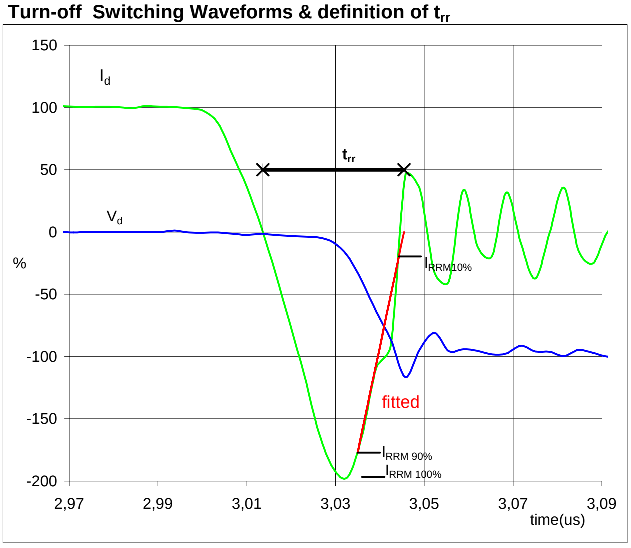
Gate voltage vs Gate charge (measured)



V_{GEoff} =	0	V
V_{GEon} =	10	V
V_C (100%) =	400	V
I_C (100%) =	15	A
Q_g =	181,13	nC

Figure 8 BOOST FWD

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

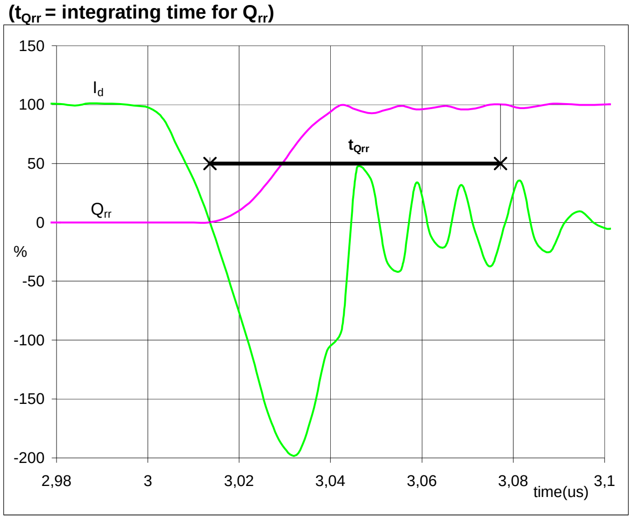


V_d (100%) =	400	V
I_d (100%) =	15	A
I_{RRM} (100%) =	-30	A
t_{rr} =	0,03	μs

Switching Definitions Boost IGBT

Figure 9 BOOST FWD

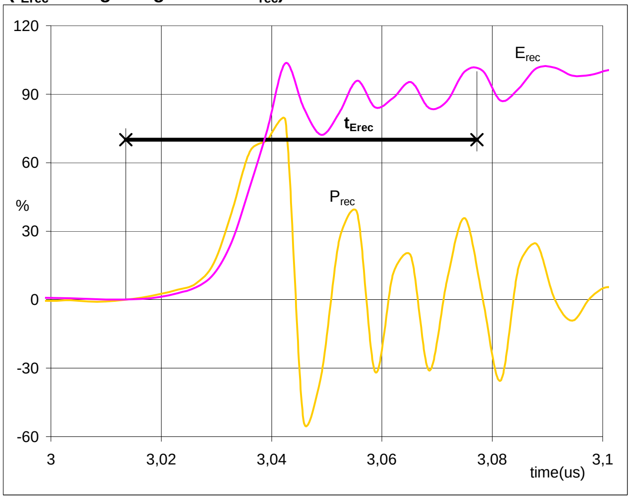
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	15	A
Q_{rr} (100%) =	0,56	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%) =	6,02	kW
E_{rec} (100%) =	0,08	mJ
t_{Erec} =	0,06	μs

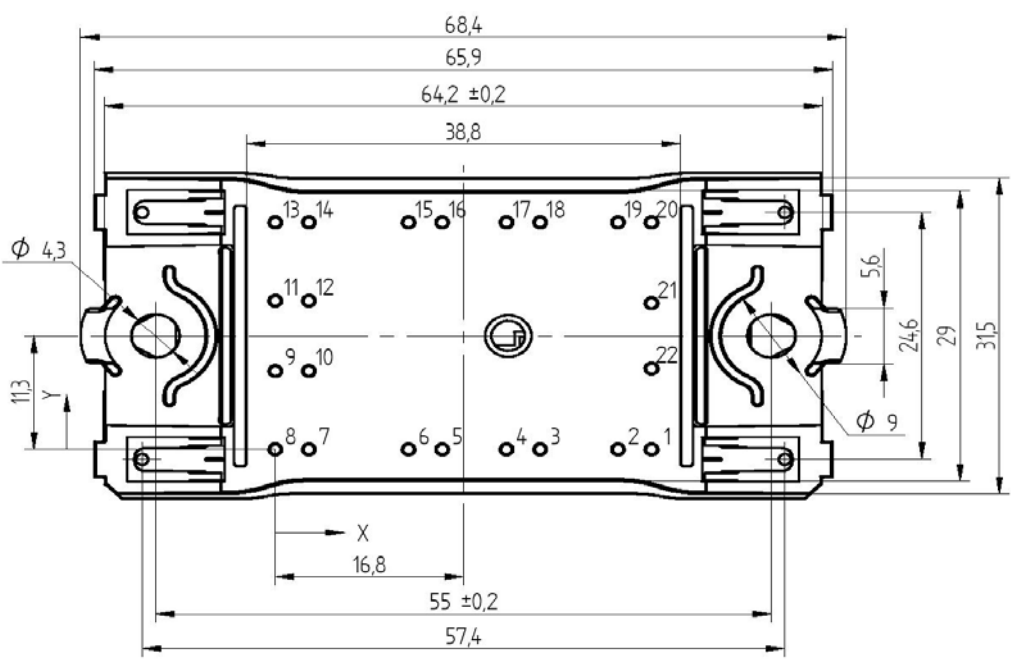
Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

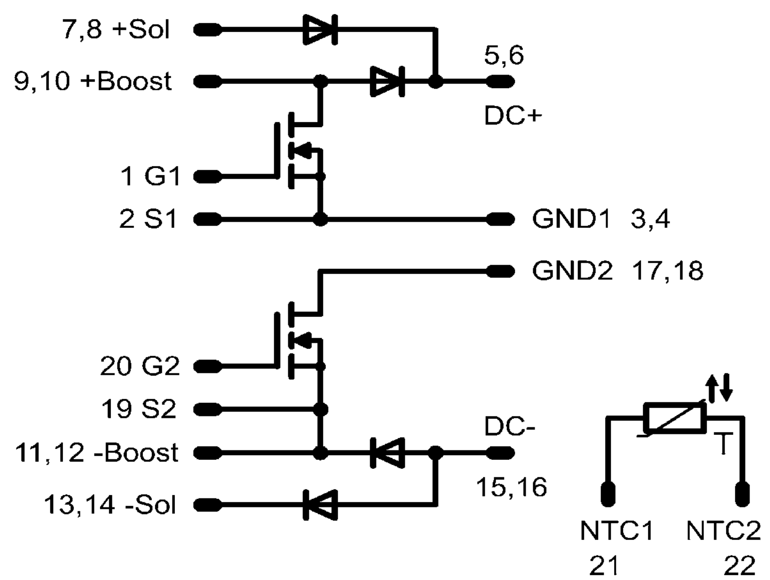
Version	Ordering Code	in DataMatrix as	in packaging barcode as
Standard in flow0 12mm housing	10-FZ06NBA041FS01-P915L78	P915L78	P915L78

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



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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.
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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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