

flowBOOST 0
600 V/50 A
Features

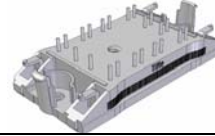
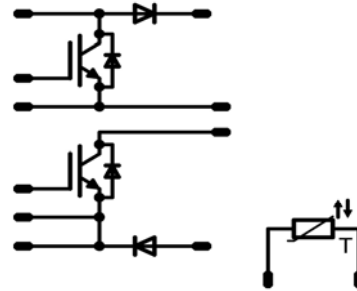
- Symmetric boost
- Clip-In PCB mounting
- Low Inductance Layout

Target Applications

- UPS

Types

- 10-FZ06NBA050SA-P915L33

flow 0 housing

Schematic


Maximum Ratings

 T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Input Boost IGBT				
Collector-emitter break down voltage	V _{CE}		600	V
DC collector current	I _C	T _j =T _{jmax} T _n =80°C T _c =80°C	49 64	A
Repetitive peak collector current	I _{Cpulse}	t _p limited by T _{jmax}	150	A
Power dissipation per IGBT	P _{tot}	T _j =T _{jmax} T _n =80°C T _c =80°C	86 130	W
Gate-emitter peak voltage	V _{GE}		±20	V
Short circuit ratings	t _{SC} V _{CC}	T _j ≤150°C V _{GE} =15V	6 360	μs V
Maximum Junction Temperature	T _{jmax}		175	°C

Input Boost Inverse Diode

Peak Repetitive Reverse Voltage	V _{RRM}	T _j =25°C	600	V
DC forward current	I _F	T _j =T _{jmax} T _n =80°C T _c =80°C	24 32	A
Repetitive peak forward current	I _{FRM}	t _p limited by T _{jmax}	40	A
Power dissipation per Diode	P _{tot}	T _j =T _{jmax} T _n =80°C T _c =80°C	38 58	W
Maximum Junction Temperature	T _{jmax}		175	°C

Maximum Ratings

 T_j=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 _{jmax}	T _h =80°C	43	A
			T _c =80°C	56	
Repetitive peak forward current	I _{FRM}	t _p limited by T _{jmax}	T _c =100°C	100	A
Power dissipation	P _{tot}	T _j =T _{jmax}	T _h =80°C	62	W
			T _c =80°C	93	
Maximum Junction Temperature	T _{jmax}		175	°C	

Thermal Properties

Storage temperature	T _{stg}		-40...+125	°C
Operation temperature under switching condition	T _{op}		-40...+(T _{jmax} - 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 $I_b[A]$	T_j	Min	Typ	Max		
Input Boost IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,0008	$T_j=25^{\circ}C$ $T_j=150^{\circ}C$	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		50	$T_j=25^{\circ}C$ $T_j=150^{\circ}C$	1	1,56 1,72	2,05	V
Collector-emitter cut-off	I_{CES}		0	600		$T_j=25^{\circ}C$ $T_j=150^{\circ}C$			0,14	mA
Gate-emitter leakage current	I_{GES}		± 20	0		$T_j=25^{\circ}C$ $T_j=150^{\circ}C$			650	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	$R_{gon}=8 \Omega$ $R_{goff}=8 \Omega$	± 15	300	50	$T_j=25^{\circ}C$		105		ns
Rise time	t_r					$T_j=150^{\circ}C$		106		
Turn-off delay time	$t_{d(off)}$					$T_j=25^{\circ}C$		13		
Fall time	t_f					$T_j=150^{\circ}C$		17		
Turn-on energy loss per pulse	E_{on}					$T_j=25^{\circ}C$		171		
Turn-off energy loss per pulse	E_{off}					$T_j=150^{\circ}C$		192		
Input capacitance	C_{ies}									
Output capacitance	C_{oss}	f=1MHz	0	25				200		
Reverse transfer capacitance	C_{rss}							93		
Gate charge	Q_{Gate}	f=1MHz	0	25		$T_j=25^{\circ}C$		310		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness $\leq 50\mu m$ $\lambda = 1 W/mK$						1,11		K/W
Input Boost Inverse Diode										
Diode forward voltage	V_F				20	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	1	1,54 1,47	2,05	V
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness $\leq 50\mu m$ $\lambda = 1 W/mK$						2,50		K/W
Input Boost FWD										
Forward voltage	V_F				50	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	1	1,57 1,51	2	V
Reverse leakage current	I_{rm}		± 15	600		$T_j=25^{\circ}C$ $T_j=125^{\circ}C$			30	μA
Peak recovery current	I_{RRM}	$R_{gon}=8 \Omega$	± 15	300	50	$T_j=25^{\circ}C$		62		A
Reverse recovery time	t_{rr}					$T_j=125^{\circ}C$		76		
Reverse recovery charge	Q_{rr}					$T_j=25^{\circ}C$		110		
Reverse recovered energy	E_{rec}					$T_j=125^{\circ}C$		193		
Peak rate of fall of recovery current	$di(rec)max/dt$					$T_j=25^{\circ}C$		2,36		
						$T_j=125^{\circ}C$		5,03		
						$T_j=25^{\circ}C$		0,52		
		$T_j=125^{\circ}C$		1,18						
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness $\leq 50\mu m$ $\lambda = 1 W/mK$						1,54		K/W
Thermistor										
Rated resistance	R					$T_j=25^{\circ}C$		22000		Ω
Deviation of R100	$\Delta_{R/R}$	R100=1486 Ω				$T_j=100^{\circ}C$	-5		+5	%
Power dissipation	P					$T_j=25^{\circ}C$		200		mW
Power dissipation constant						$T_j=25^{\circ}C$		2		mW/K
B-value	$B_{(25/50)}$	Tol. $\pm 3\%$				$T_j=25^{\circ}C$		3950		K
B-value	$B_{(25/100)}$	Tol. $\pm 3\%$				$T_j=25^{\circ}C$		3996		K
Vincotech NTC Reference						$T_j=25^{\circ}C$			B	

INPUT BOOST

Figure 1 BOOST IGBT
Typical output characteristics

$$I_D = f(V_{DS})$$

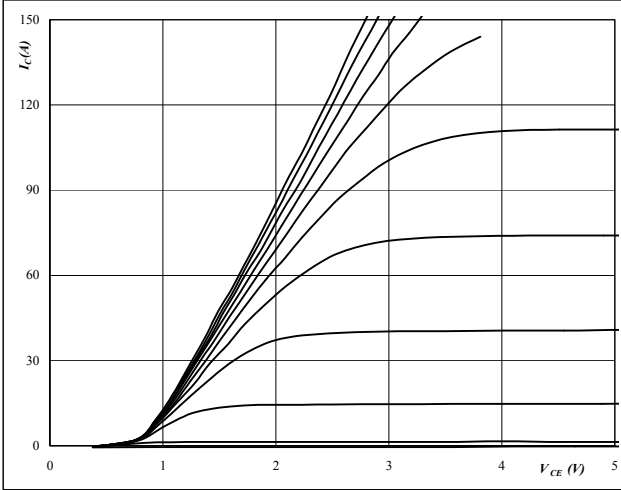

At
 $t_p = 250 \mu\text{s}$
 $T_j = 25 \text{ }^\circ\text{C}$
 V_{DS} from 6 V to 16 V in steps of 1 V

Figure 2 BOOST IGBT
Typical output characteristics

$$I_D = f(V_{DS})$$

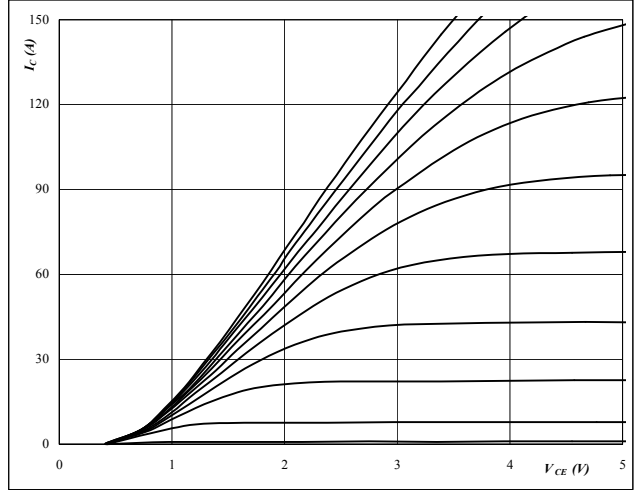
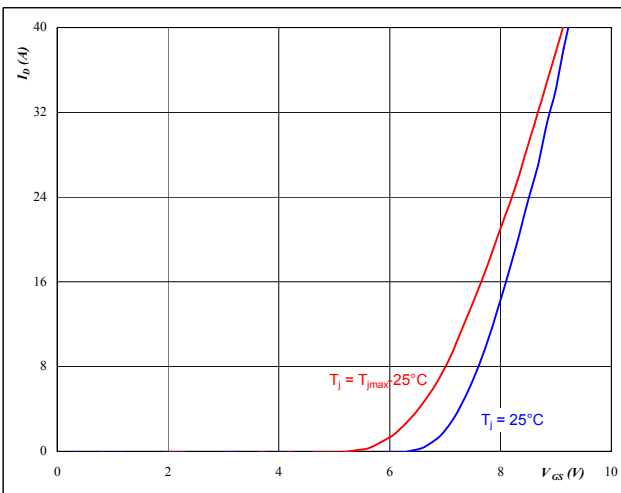
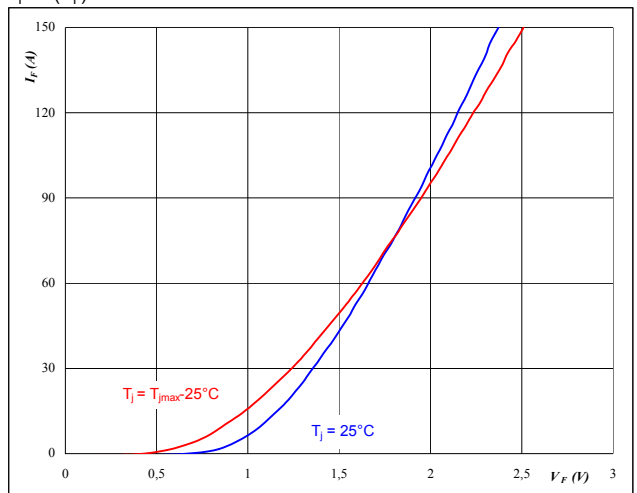

At
 $t_p = 250 \mu\text{s}$
 $T_j = 150 \text{ }^\circ\text{C}$
 V_{DS} from 6 V to 16 V in steps of 1 V

Figure 3 BOOST IGBT
Typical transfer characteristics

$$I_D = f(V_{DS})$$


At
 $t_p = 250 \mu\text{s}$
 $V_{DS} = 10 \text{ V}$
Figure 4 BOOST FWD
Typical diode forward current as a function of forward voltage

$$I_F = f(V_F)$$

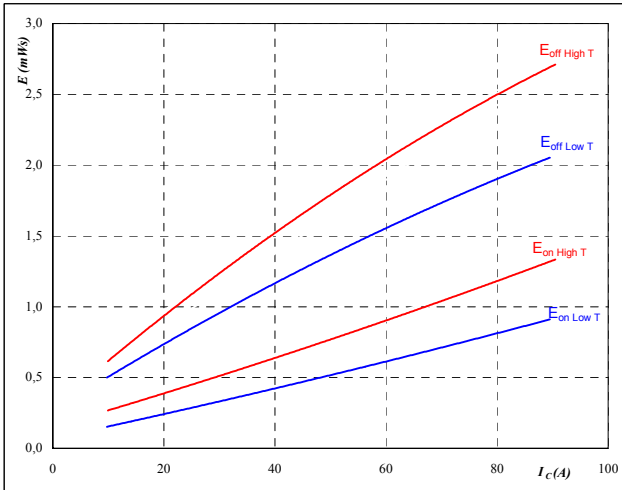

At
 $t_p = 250 \mu\text{s}$

INPUT BOOST

Figure 5 BOOST IGBT

**Typical switching energy losses
as a function of collector current**

$$E = f(I_D)$$



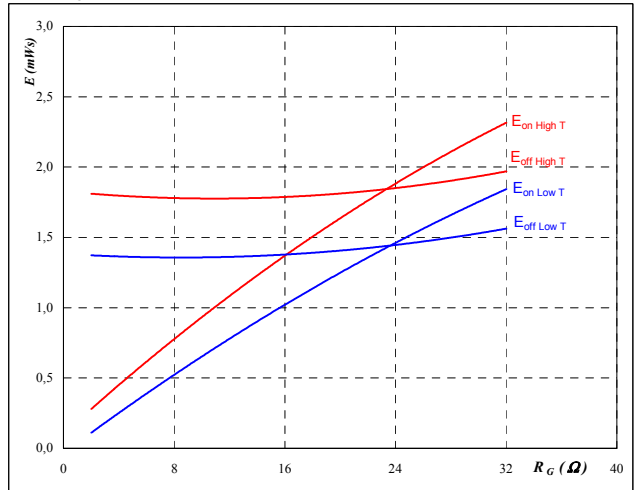
With an inductive load at

$T_j =$	25/150	°C
$V_{DS} =$	300	V
$V_{GS} =$	±15	V
$R_{gon} =$	8	Ω
$R_{goff} =$	8,015	Ω

Figure 6 BOOST IGBT

**Typical switching energy losses
as a function of gate resistor**

$$E = f(R_G)$$



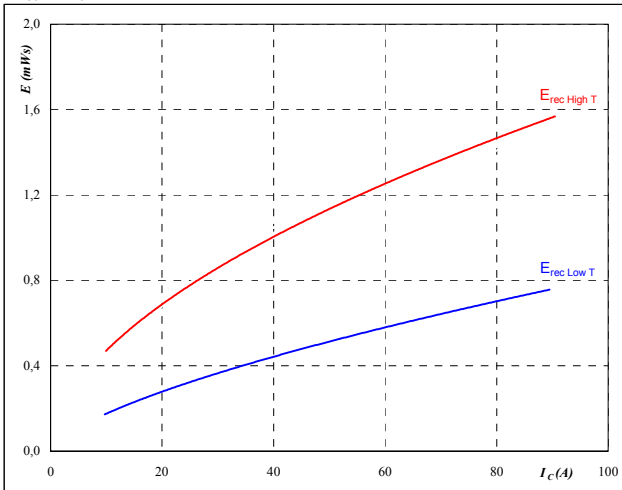
With an inductive load at

$T_j =$	25/150	°C
$V_{DS} =$	300	V
$V_{GS} =$	±15	V
$I_D =$	50	A

Figure 7 BOOST IGBT

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

$$E_{rec} = f(I_C)$$



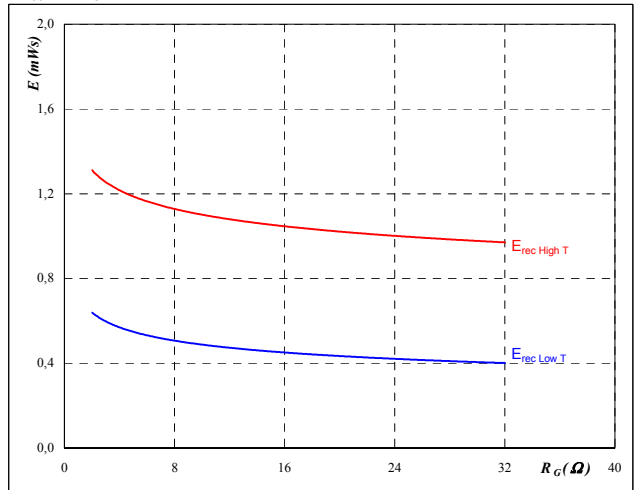
With an inductive load at

$T_j =$	25/150	°C
$V_{DS} =$	300	V
$V_{GS} =$	±15	V
$R_{gon} =$	8	Ω
$R_{goff} =$	8,015	Ω

Figure 8 BOOST IGBT

**Typical reverse recovery energy loss
as a function of gate resistor**

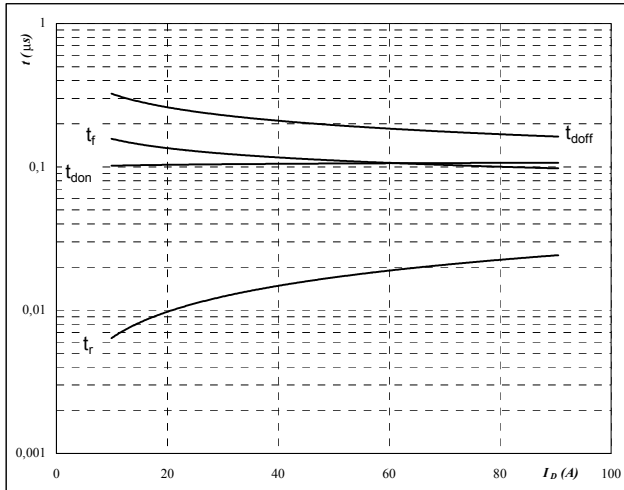
$$E_{rec} = f(R_G)$$



With an inductive load at

$T_j =$	25/150	°C
$V_{DS} =$	300	V
$V_{GS} =$	±15	V
$I_D =$	50	A

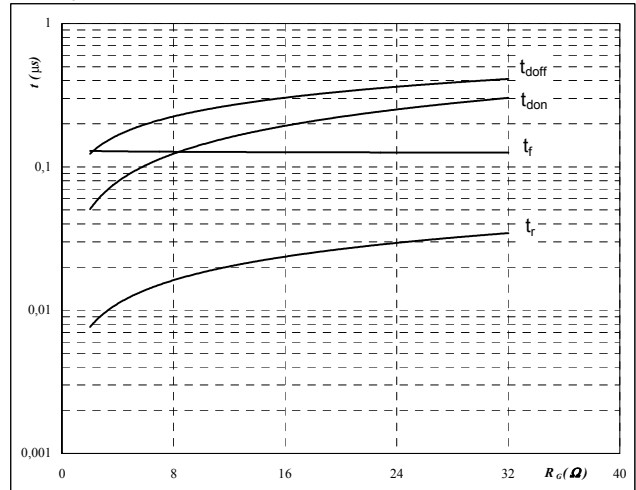
INPUT BOOST
Figure 9 BOOST IGBT

Typical switching times as a function of collector current
 $t = f(I_C)$


With an inductive load at

$T_j =$	150	°C
$V_{DS} =$	300	V
$V_{GS} =$	±15	V
$R_{gon} =$	8	Ω
$R_{goff} =$	8,015	Ω

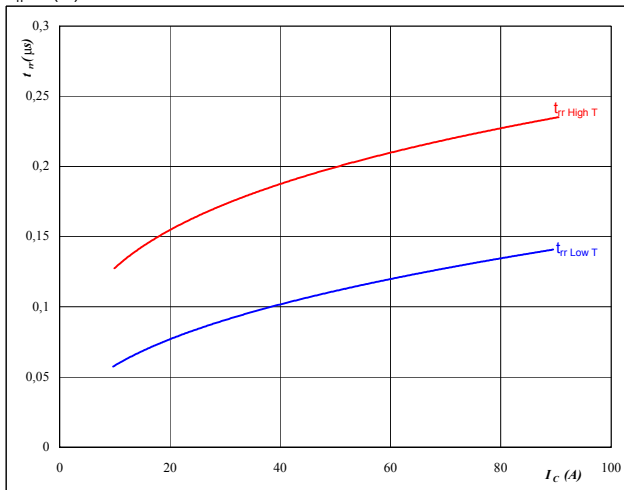
Figure 10 BOOST IGBT

Typical switching times as a function of gate resistor
 $t = f(R_G)$


With an inductive load at

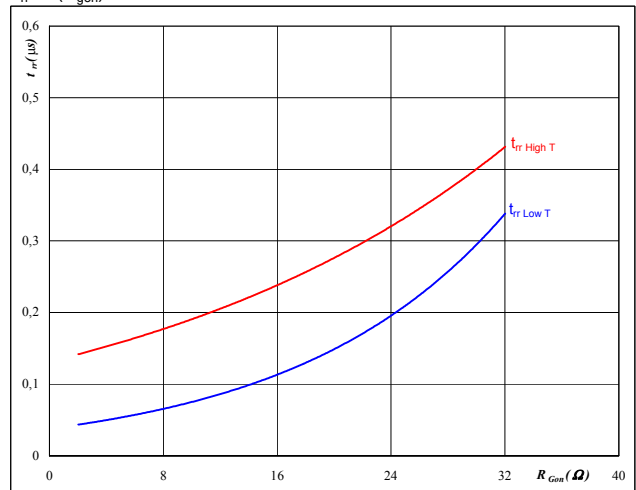
$T_j =$	150	°C
$V_{DS} =$	300	V
$V_{GS} =$	±15	V
$I_C =$	50	A

Figure 11 BOOST FWD

Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_C)$

At

$T_j =$	25/150	°C
$V_{DS} =$	300	V
$V_{GS} =$	±15	V
$R_{gon} =$	8	Ω

Figure 12 BOOST FWD

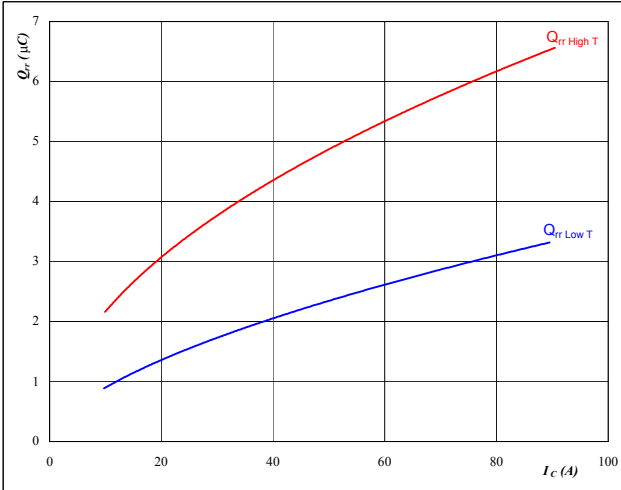
Typical reverse recovery time as a function of MOSFET turn on gate resistor
 $t_{rr} = f(R_{gon})$

At

$T_j =$	25/150	°C
$V_R =$	300	V
$I_F =$	50	A
$V_{GS} =$	±15	V

INPUT BOOST
Figure 13 BOOST FWD

Typical reverse recovery charge as a function of collector current

$$Q_{rr} = f(I_C)$$


At
 $T_j = 25/150$ °C
 $V_{DS} = 300$ V
 $V_{GS} = \pm 15$ V
 $R_{gon} = 8$ Ω
Figure 14 BOOST FWD

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

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

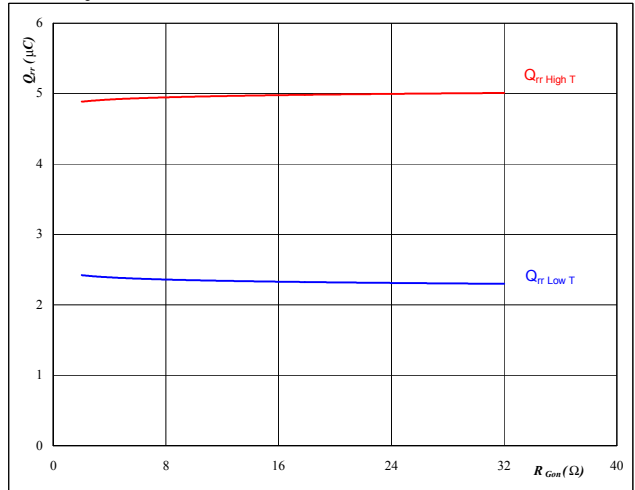
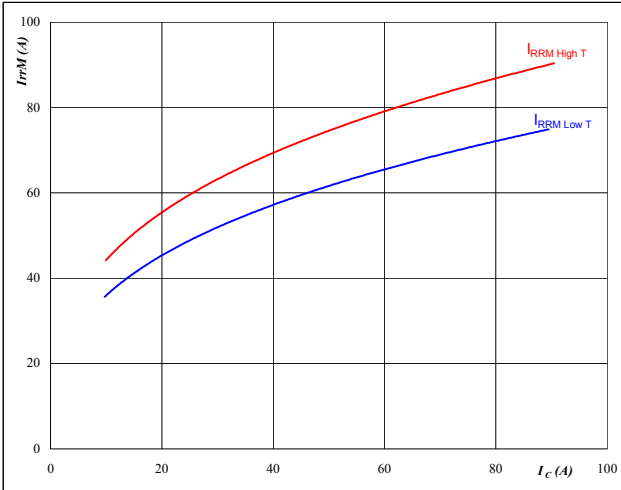

At
 $T_j = 25/150$ °C
 $V_R = 300$ V
 $I_F = 50$ A
 $V_{GS} = \pm 15$ V

Figure 15 BOOST FWD

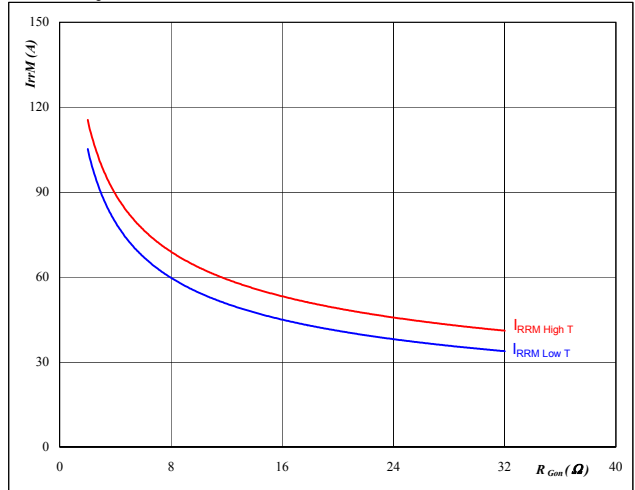
Typical reverse recovery current as a function of collector current

$$I_{RRM} = f(I_C)$$


At
 $T_j = 25/150$ °C
 $V_{DS} = 300$ V
 $V_{GS} = \pm 15$ V
 $R_{gon} = 8$ Ω
Figure 16 BOOST FWD

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

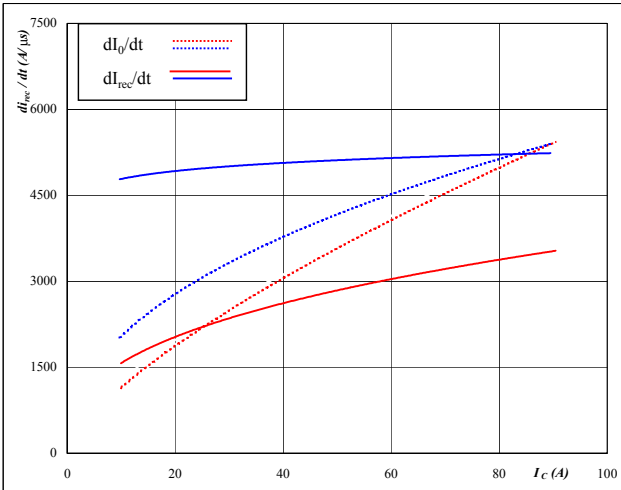
$$I_{RRM} = f(R_{gon})$$


At
 $T_j = 25/150$ °C
 $V_R = 300$ V
 $I_F = 50$ A
 $V_{GS} = \pm 15$ V

INPUT BOOST

Figure 17 BOOST FWD

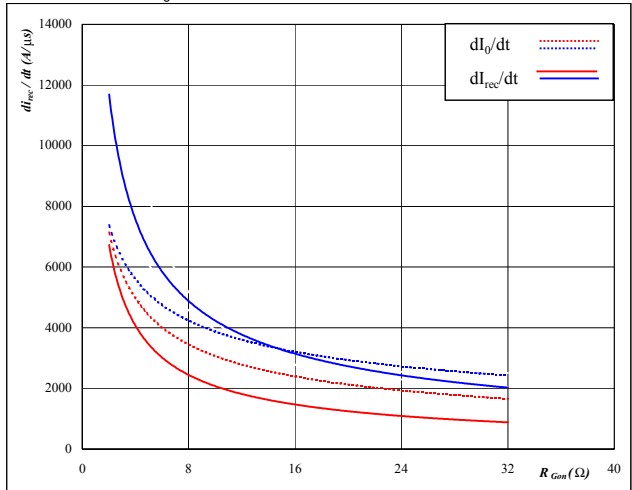
Typical rate of fall of forward and reverse recovery current as a function of collector current
 $dI_f/dt, dI_{rec}/dt = f(I_c)$



At
 $T_j = 25/150 \text{ } ^\circ\text{C}$
 $V_{CE} = 300 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 8 \text{ } \Omega$

Figure 18 BOOST FWD

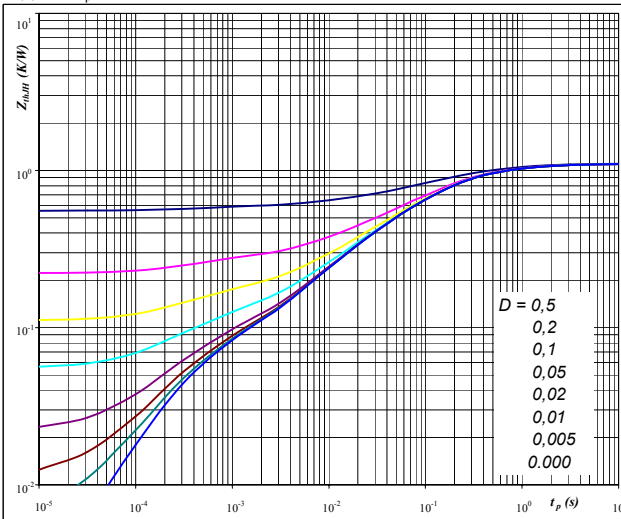
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
 $dI_f/dt, dI_{rec}/dt = f(R_{gon})$



At
 $T_j = 25/150 \text{ } ^\circ\text{C}$
 $V_{ce} = 300 \text{ V}$
 $I_f = 50 \text{ A}$
 $V_{gs} = \pm 15 \text{ V}$

Figure 19 BOOST IGBT

MOSFET transient thermal impedance as a function of pulse width
 $Z_{thJH} = f(t_p)$

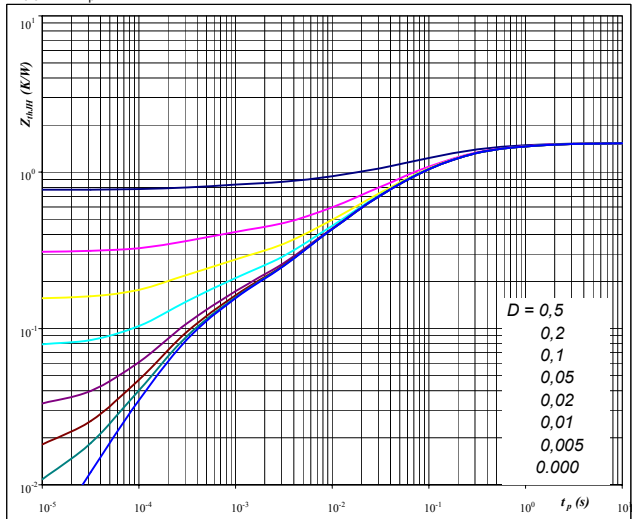


At
 $D = t_p / T$
 $R_{thJH} = 1,11 \text{ K/W}$ IGBT thermal model values

R (C/W)	Tau (s)
0,026	8,62E+00
0,152	1,02E+00
0,513	1,67E-01
0,267	3,13E-02
0,092	5,52E-03
0,060	3,41E-04

Figure 20 BOOST FWD

FWD transient thermal impedance as a function of pulse width
 $Z_{thJH} = f(t_p)$



At
 $D = t_p / T$
 $R_{thJH} = 1,54 \text{ K/W}$ FWD thermal model values

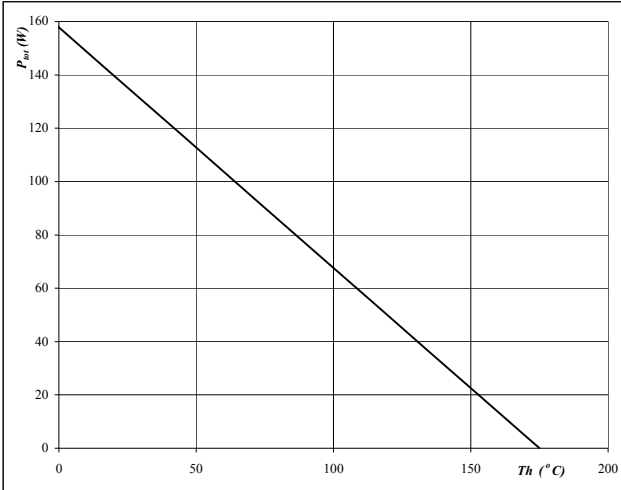
R (C/W)	Tau (s)
0,04	7,97E+00
0,19	7,69E-01
0,61	1,31E-01
0,45	2,65E-02
0,15	4,42E-03
0,11	3,20E-04

INPUT BOOST

Figure 21 BOOST IGBT

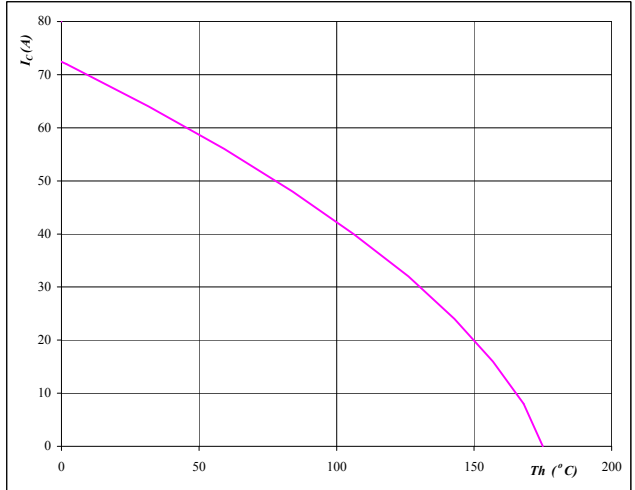
Power dissipation as a function of heatsink temperature

$$P_{tot} = f(T_h)$$


At
 $T_j = 175 \text{ } ^\circ\text{C}$
Figure 22 BOOST IGBT

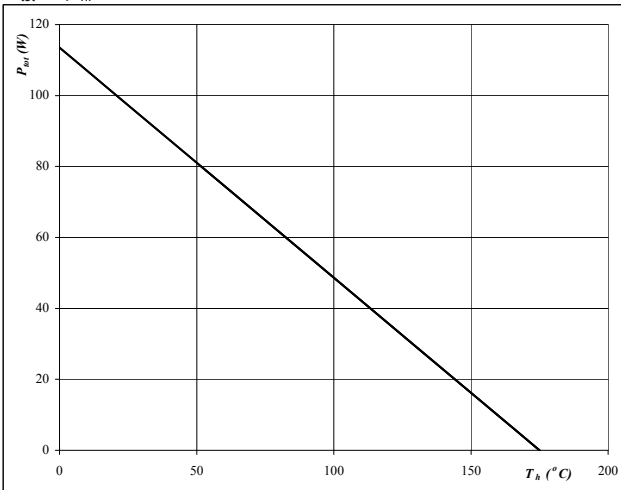
Collector/Drain current as a function of heatsink temperature

$$I_C = f(T_h)$$


At
 $T_j = 175 \text{ } ^\circ\text{C}$
 $V_{GS} = 15 \text{ V}$
Figure 23 BOOST FWD

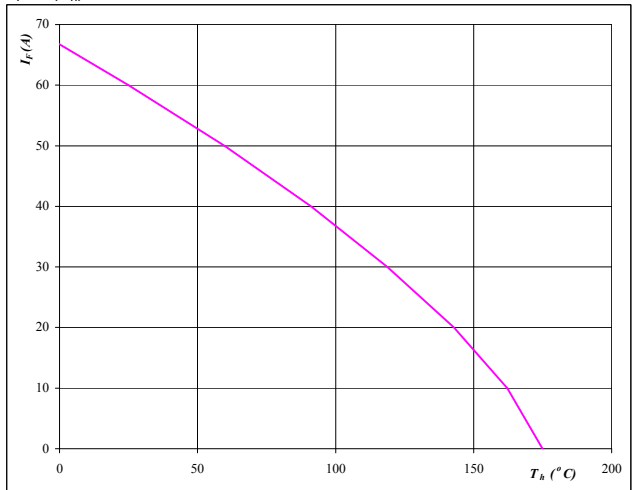
Power dissipation as a function of heatsink temperature

$$P_{tot} = f(T_h)$$

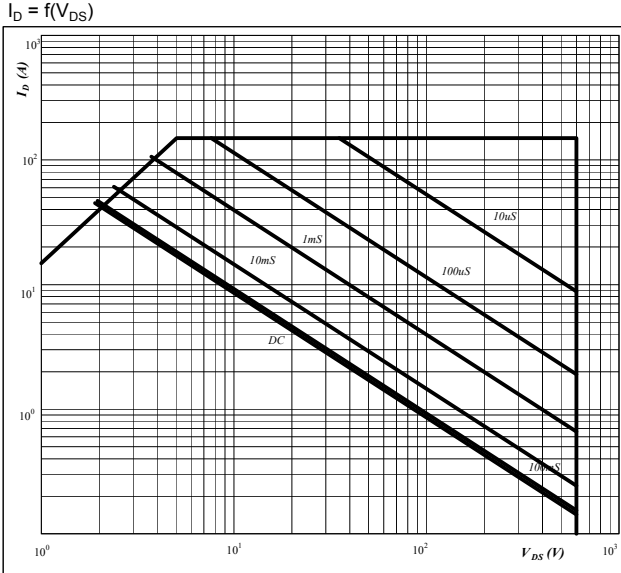

At
 $T_j = 175 \text{ } ^\circ\text{C}$
Figure 24 BOOST FWD

Forward current as a function of heatsink temperature

$$I_F = f(T_h)$$

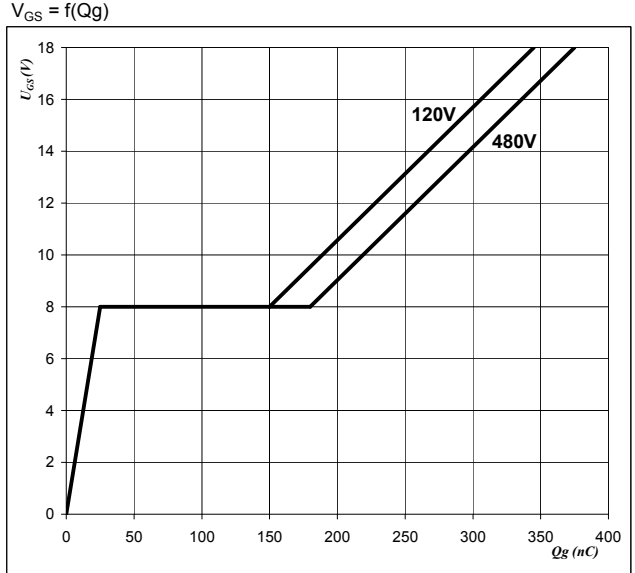

At
 $T_j = 175 \text{ } ^\circ\text{C}$

INPUT BOOST
Figure 25 BOOST IGBT

Safe operating area as a function of drain-source voltage
 $I_D = f(V_{DS})$


At
 D = single pulse
 $T_h = 80 \text{ } ^\circ\text{C}$
 $V_{GS} = \pm 15 \text{ V}$
 $T_j = T_{jmax} \text{ } ^\circ\text{C}$

Figure 26 BOOST IGBT

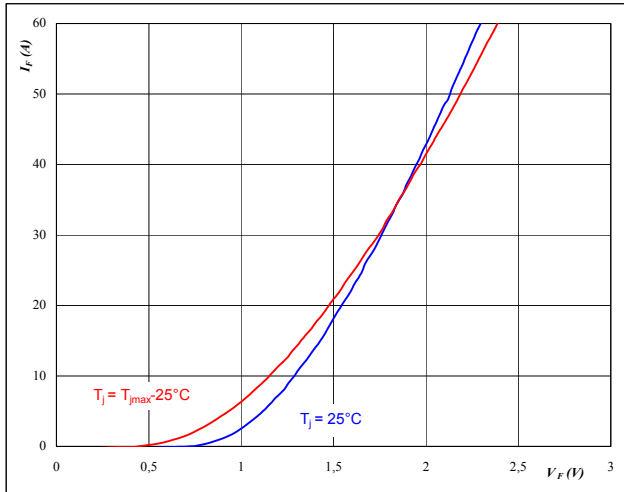
Gate voltage vs Gate charge
 $V_{GS} = f(Q_g)$


At
 $I_D = 50 \text{ A}$

BOOST INV. DIODE
Figure 1 BOOST INV DIODE

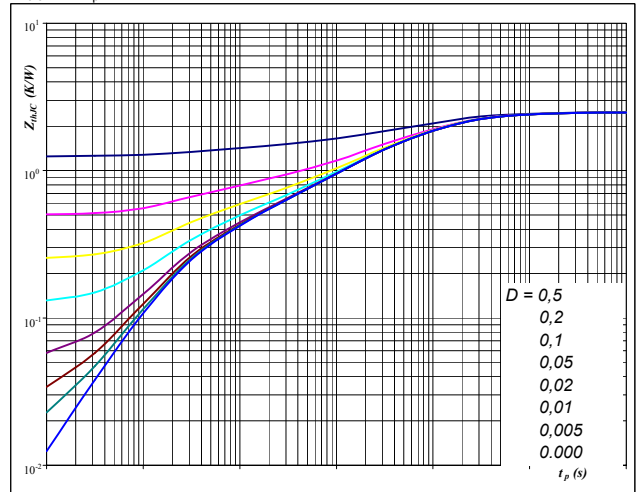
Typical diode forward current as a function of forward voltage

$$I_F = f(V_F)$$


At
 $t_p = 250 \mu s$
Figure 2 BOOST INV DIODE

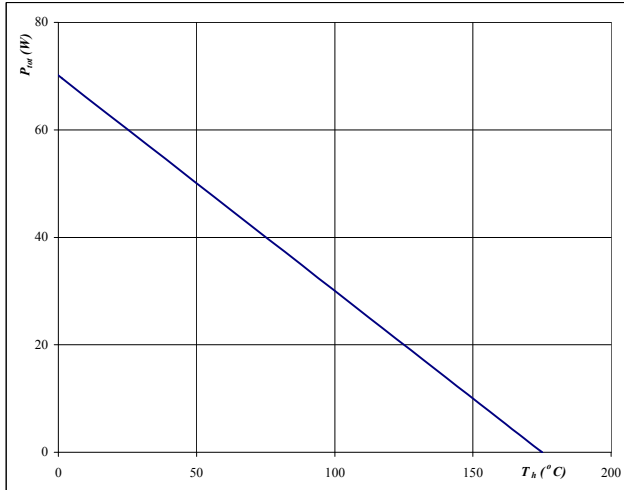
Diode transient thermal impedance as a function of pulse width

$$Z_{thJH} = f(t_p)$$


At
 $D = t_p / T$
 $R_{thJH} = 2,496 \text{ K/W}$
Figure 3 BOOST INV DIODE

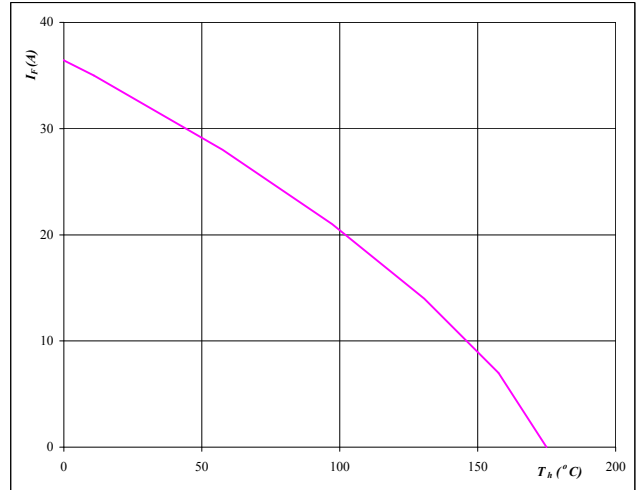
Power dissipation as a function of heatsink temperature

$$P_{tot} = f(T_h)$$


At
 $T_j = 175 \text{ °C}$
Figure 4 BOOST INV DIODE

Forward current as a function of heatsink temperature

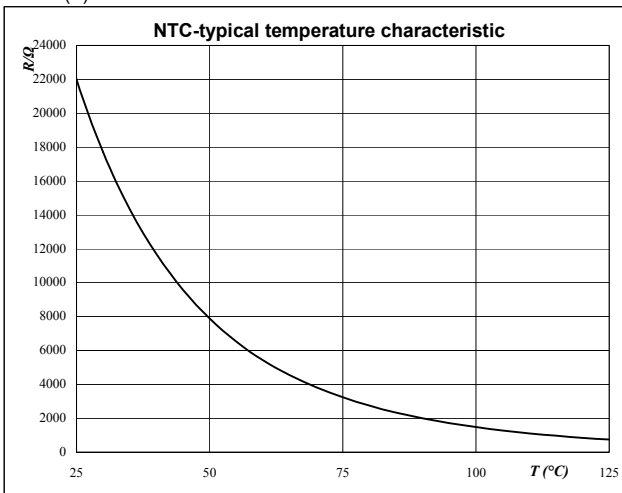
$$I_F = f(T_h)$$


At
 $T_j = 175 \text{ °C}$

Thermistor

Figure 1 Thermistor

Typical NTC characteristic
 as a function of temperature

 $R_T = f(T)$

Figure 2 Thermistor

Typical NTC resistance values

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

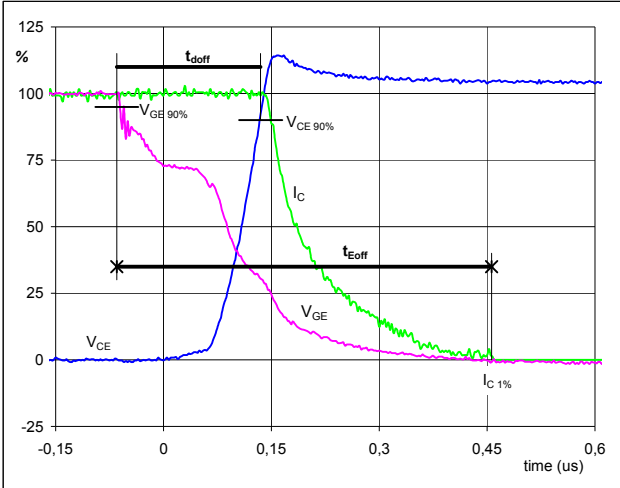
T [°C]	R [Ω]	T [°C]	R [Ω]
-55	3006477	30	17635
-50	1993973	40	11574
-45	1346473	50	7796
-40	924676	55	6457
-35	645112	60	5378
-30	456784	65	4503
-25	327965	70	3791
-20	238577	75	3207
-15	175705	80	2726
-10	130914	85	2327
-5	98618	90	1996
0	75063	95	1718
5	57698	100	1486
10	44764	105	1289
15	35037	110	1123
20	27654	115	982
25	22000	120	861
30	17635	125	758

Switching Definitions Boost IGBT

General conditions

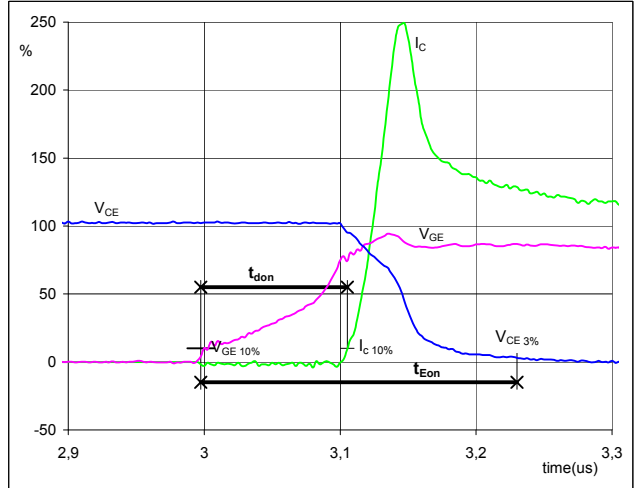
T_j	=	150 °C
R_{gon}	=	8 Ω
R_{goff}	=	8 Ω

Figure 1 BOOST IGBT

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


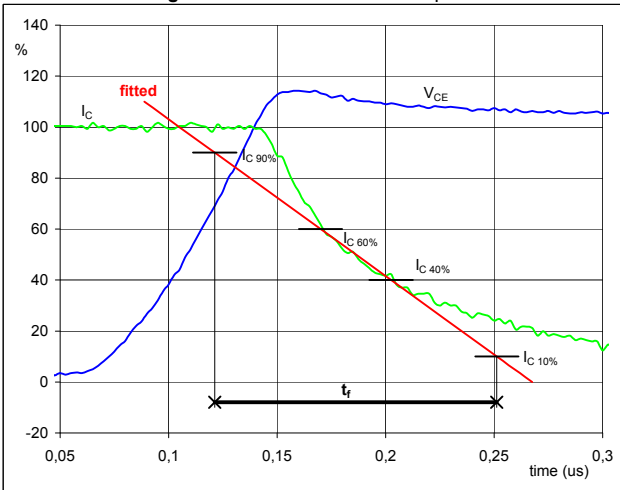
$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	300	V
$I_C(100\%) =$	50	A
$t_{doff} =$	0,19	μ S
$t_{Eoff} =$	0,52	μ S

Figure 2 BOOST IGBT

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


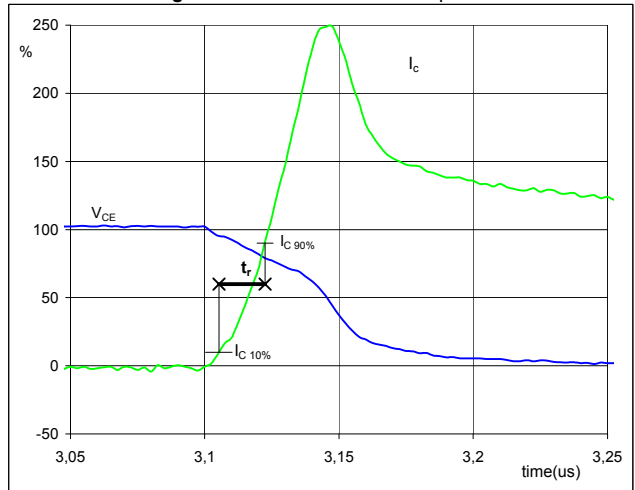
$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	300	V
$I_C(100\%) =$	50	A
$t_{don} =$	0,11	μ S
$t_{Eon} =$	0,23	μ S

Figure 3 BOOST IGBT

Turn-off Switching Waveforms & definition of t_r


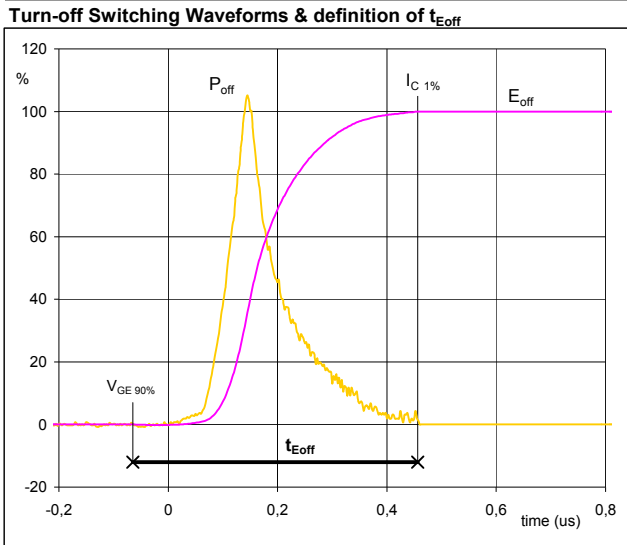
$V_C(100\%) =$	300	V
$I_C(100\%) =$	50	A
$t_r =$	0,12	μ S

Figure 4 BOOST IGBT

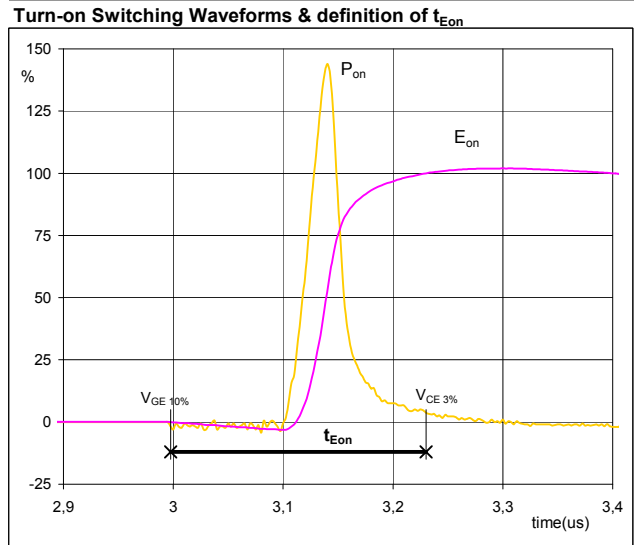
Turn-on Switching Waveforms & definition of t_r


$V_C(100\%) =$	300	V
$I_C(100\%) =$	50	A
$t_r =$	0,02	μ S

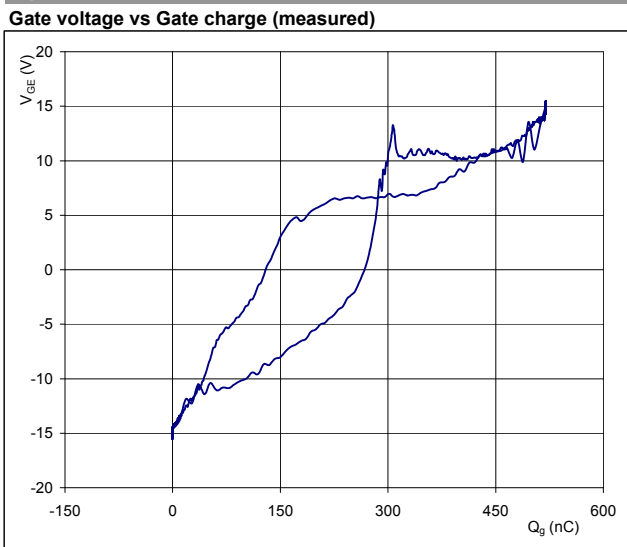
Switching Definitions Boost IGBT

Figure 5 BOOST IGBT


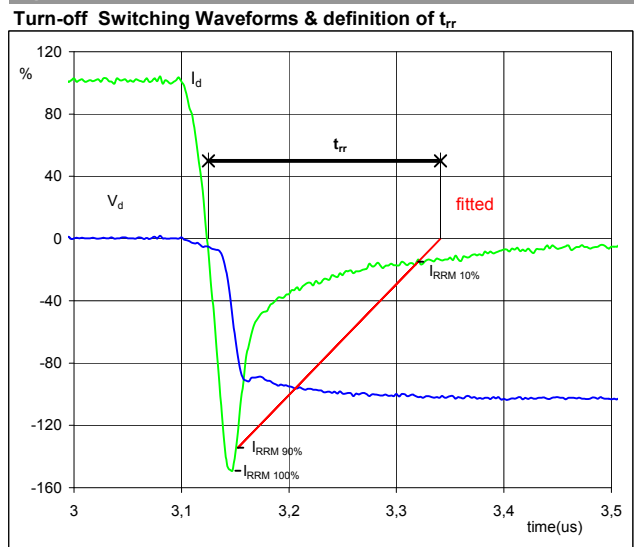
$P_{off} (100\%) =$	15,01	kW
$E_{off} (100\%) =$	1,75	mJ
$t_{Eoff} =$	0,52	μ s

Figure 6 BOOST IGBT


$P_{on} (100\%) =$	15,01	kW
$E_{on} (100\%) =$	0,77	mJ
$t_{Eon} =$	0,23	μ s

Figure 7 BOOST IGBT


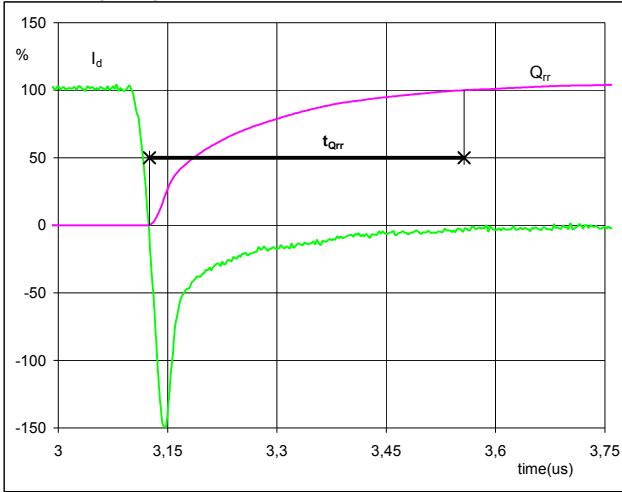
$V_{GEoff} =$	-15	V
$V_{GEon} =$	15	V
$V_C (100\%) =$	300	V
$I_C (100\%) =$	50	A
$Q_g =$	524,49	nC

Figure 8 BOOST FWD


$V_d (100\%) =$	300	V
$I_d (100\%) =$	50	A
$I_{RRM} (100\%) =$	-76	A
$t_{rr} =$	0,19	μ s

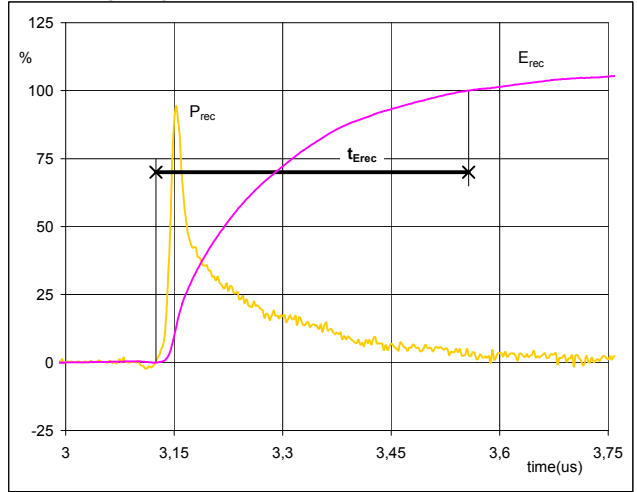
Switching Definitions Boost IGBT

Figure 9 BOOST FWD

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


I_d (100%) =	50	A
Q_{rr} (100%) =	5,03	μC
t_{Qrr} =	0,43	μs

Figure 10 BOOST FWD

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


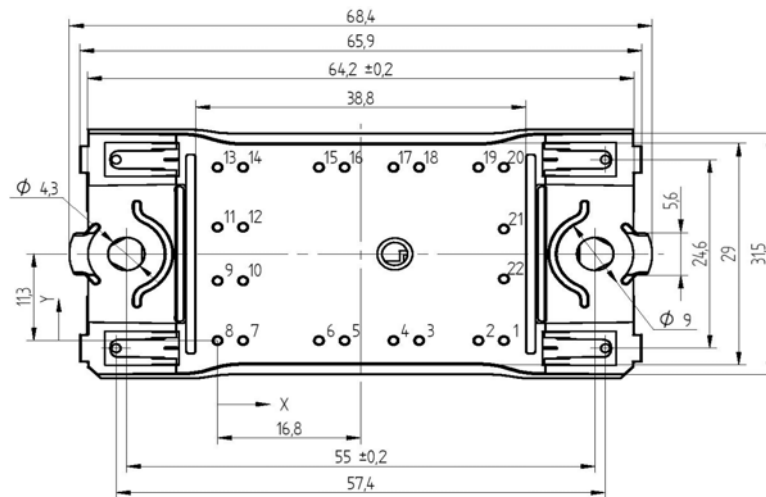
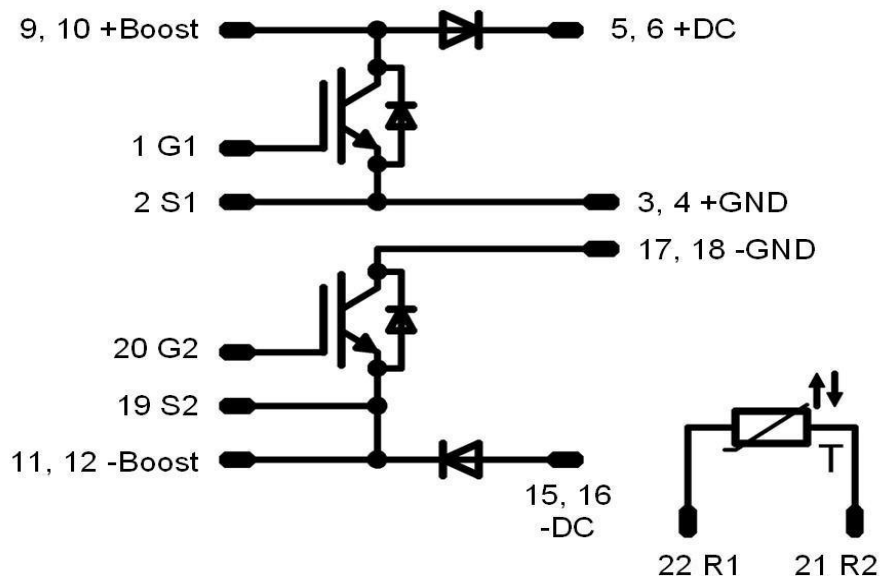
P_{rec} (100%) =	15,01	kW
E_{rec} (100%) =	1,18	mJ
t_{Erec} =	0,43	μs

Ordering Code and Marking - Outline - Pinout
Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
Standard in flow 0 12mm housing	10-FZ06NBA045FH-P915L33	P915L33	P915L33

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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