flowBOOST 4w — 600V/400A

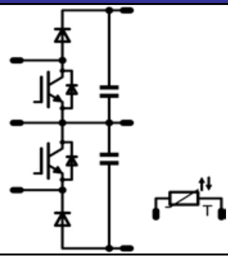
Features
- Symmetrical Booster
- Integrated DC-capacitor
- Low DC Inductance (<5nH)
- Transient Interface for optional regeneration of switching losses
- Temperature Sensor

Target Applications
- UPS (3 Phase PFC)
- Solar inverter (Booster)

Types
- 70-W206NBA400SA-M786L

FlowSCREW 4w

Schematic



Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Input Boost IGBT				
Collector-emitter break down voltage	V_{CES}		600	V
DC collector current	I_C	$T_j=T_jmax$ T_h=80°C T_c=80°C	391 500	A
Pulsed collector current	I_{Cpulse}	t_p limited by T_jmax	1200	A
Turn off safe operating area		T_j≤150°C $V_{CE}<=V_{CES}$	1200	A
Power dissipation per IGBT	P_{tot}	$T_j=T_jmax$ T_h=80°C T_c=80°C	639 968	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}		600	V
Forward average current	I_{FAV}	$T_j=T_jmax$ T_h=80°C T_c=80°C	40 81	A
I2t-value	I^2t	t_p=10ms T_j=25°C	45	A^2s
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_h=80°C T_c=80°C	113 160	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}			600	V
Forward average current	I_{FAV}	T_j=$T_j$max	T_h=80°C T_c=80°C	296 393	A
Surge forward current	I_{FSM}	t_p=10ms	T_j=25°C	tbd.	A
I2t-value	I^2t			tbd.	A^2s
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		1200	A
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	419 634	W
Maximum Junction Temperature	$T_j$max			175	°C

Parameter	Symbol	Condition		Value	Unit
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{op}			-40…+(Tjmax - 25)	°C

Parameter	Symbol	Condition		Value	Unit
Insulation Properties					
Insulation voltage		t=2s	DC voltage	4000	V
Creepage distance				min 12,7	mm
Clearance				min 12,7	mm

Characteristic Values

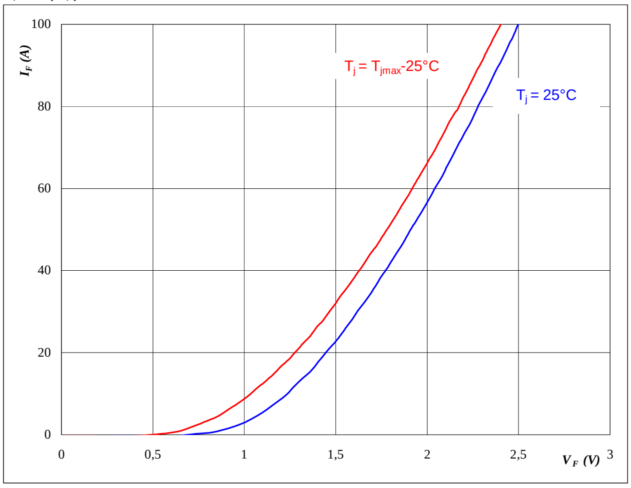
Parameter	Symbol	Conditions	V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Value Min	Value Typ	Value Max	Unit
Input Boost IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$				0,0064	Tj=25°C Tj=150°C	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		400	Tj=25°C Tj=150°C	1	1,46 1,59	2,1	V
Collector-emitter cut-off	I_{CES}		0	600		Tj=25°C Tj=150°C			0,0204	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=150°C			2400	nA
Integrated Gate resistor	R_{gint}							0,5		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=8 Ω Rgon=8 Ω	±15/8	400	414	Tj=25°C Tj=150°C		155 157		ns
Rise time	t_r					Tj=25°C Tj=150°C		35 38		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=150°C		367 389		
Fall time	t_f					Tj=25°C Tj=150°C		23 54,3		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=150°C		4,278 6,321		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=150°C		14,361 18,949		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		24640		pF
Output capacitance	C_{oss}							1536		
Reverse transfer capacitance	C_{rss}							732		
Gate charge	Q_{Gate}		±15	480	400	Tj=25°C		2480		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						0,15		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,10		
Input Boost Inverse Diode										
Diode forward voltage	V_F				20	Tj=25°C Tj=125°C	1	1,45 1,28	2,1	V
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						0,84		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,56		
Input Boost FWD										
Forward voltage	V_F				400	Tj=25°C Tj=150°C		1,57 1,58		V
Reverse leakage current	I_{rm}			600		Tj=25°C Tj=150°C			108	µA
Peak recovery current	I_{RRM}	Rgon=8 Ω	±15/8	400	414	Tj=25°C Tj=150°C		314 398		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C		153 200		ns
Reverse recovery charge	Q_{rr}					Tj=25°C Tj=150°C		16,44 30,70		µC
Reverse recovered energy	E_{rec}					Tj=25°C Tj=150°C		5,49 10,48		mWs
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=150°C		9573 6028		A/µs
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material						0,23		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,15		
Thermistor										
Rated resistance	R					T=25°C		22000		Ω
Deviation of R100	ΔR/R	R100=1486 Ω				T=25°C	-12		+14	%
Power dissipation	P					T=25°C		200		mW
Power dissipation constant						T=25°C		2		mW/K
B-value	B(25/50)	Tol. ±3%				T=25°C		3950		K
B-value	B(25/100)	Tol. ±3%				T=25°C		3996		K
Vincotech NTC Reference									B	

Boost Inverse Diode

Figure 25 Boost Inverse Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



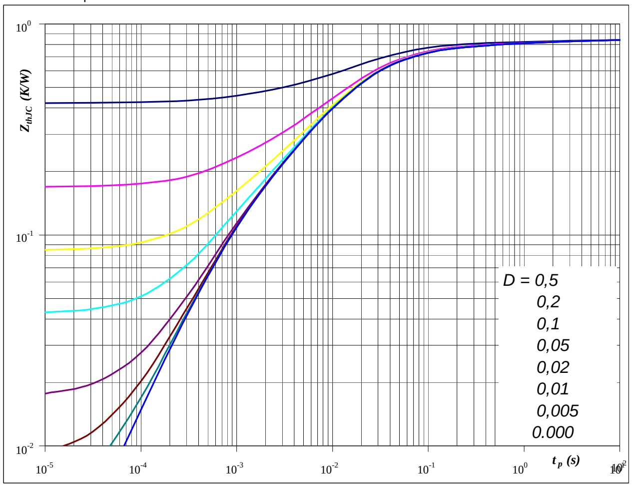
At

t_p =	250	μs

Figure 26 Boost Inverse Diode

Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



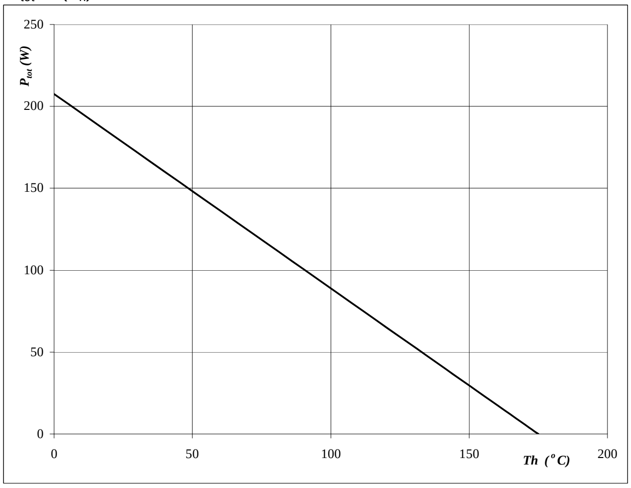
At

D =	tp / T	
R_{thJH} =	0,84	K/W

Figure 27 Boost Inverse Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



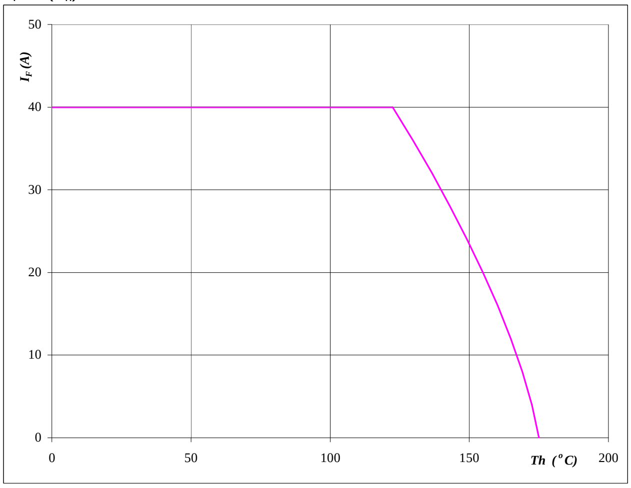
At

T_j =	175	ºC

Figure 28 Boost Inverse Diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

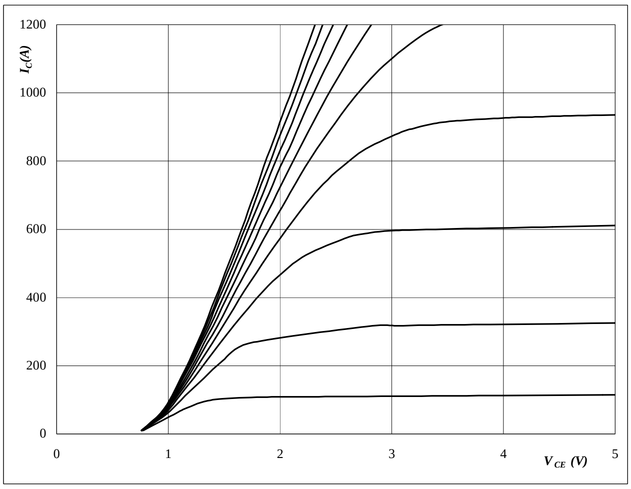
T_j =	175	ºC

INPUT BOOST

Figure 1	BOOST IGBT

Typical output characteristics

$I_D = f(V_{DS})$



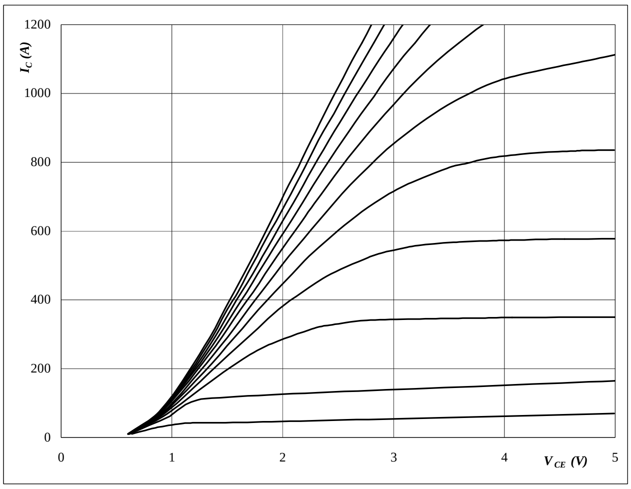
At

t_p =	350	µs
T_j =	25	°C
V_{GS} from	7 V to 17 V in steps of 1 V	

Figure 2	BOOST IGBT

Typical output characteristics

$I_D = f(V_{DS})$



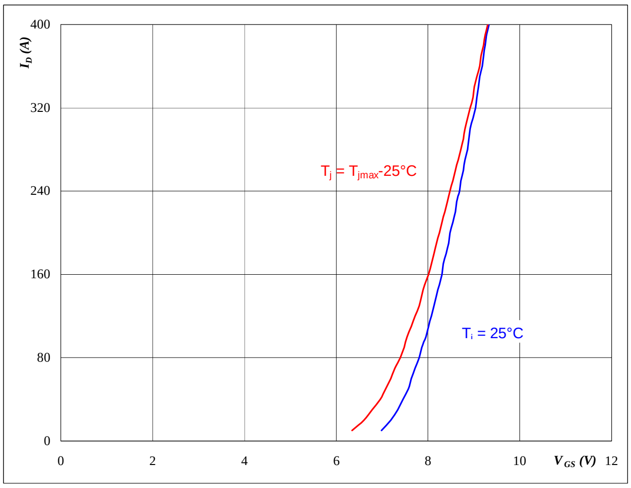
At

t_p =	350	µs
T_j =	125	°C
V_{GS} from	7 V to 17 V in steps of 1 V	

Figure 3	BOOST IGBT

Typical transfer characteristics

$I_D = f(V_{GS})$



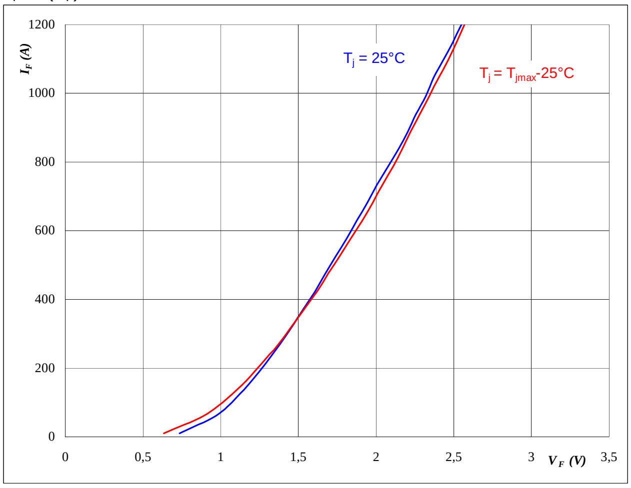
At

t_p =	350	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

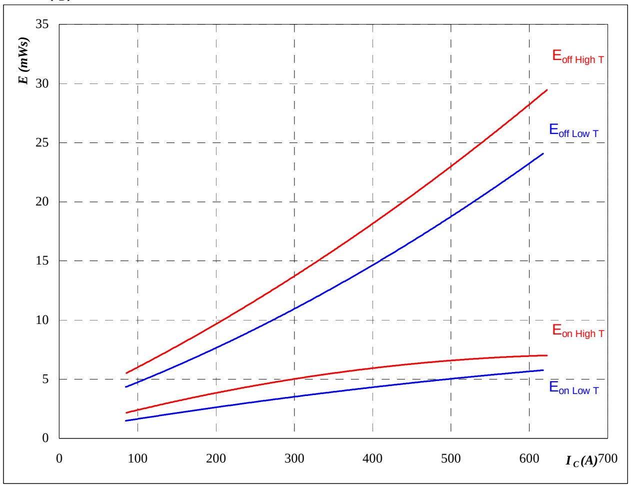
t_p =	350	µs

INPUT BOOST

Figure 5 BOOST IGBT

Typical switching energy losses
as a function of collector current

$E = f(I_D)$



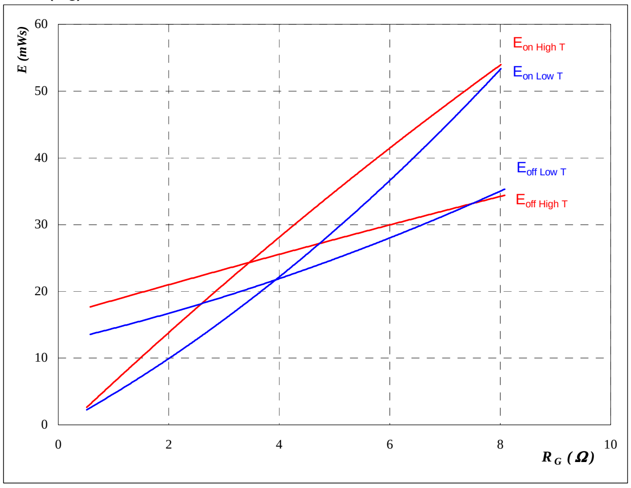
With an inductive load at

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	+15/-8	V
R_{gon} =	1	Ω
R_{goff} =	1	Ω

Figure 6 BOOST IGBT

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



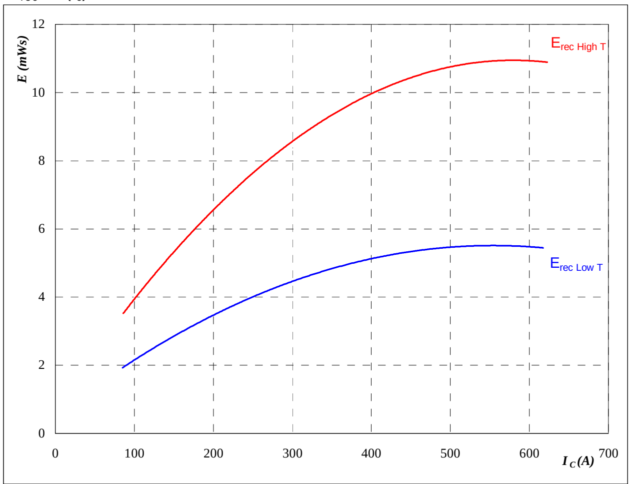
With an inductive load at

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	+15/-8	V
I_D =	414	A

Figure 7 BOOST FWD

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

$E_{rec} = f(I_c)$



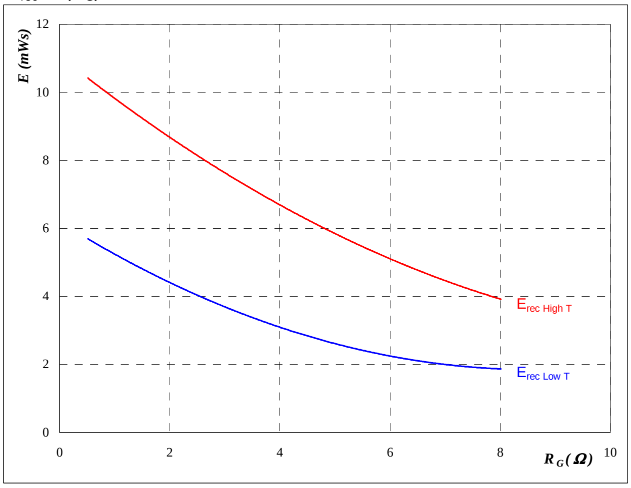
With an inductive load at

T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	+15/-8	V
R_{gon} =	1	Ω
R_{goff} =	1	Ω

Figure 8 BOOST FWD

Typical reverse recovery energy loss
as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

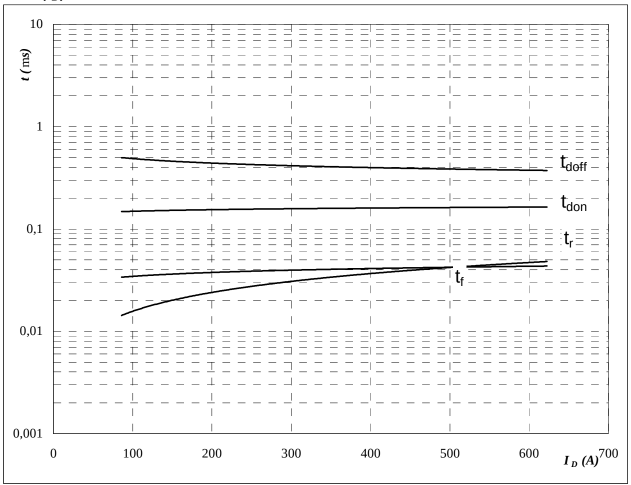
T_j =	25/125	°C
V_{DS} =	400	V
V_{GS} =	+15/-8	V
I_D =	414	A

INPUT BOOST

Figure 9 BOOST IGBT

Typical switching times as a function of collector current

$t = f(I_D)$



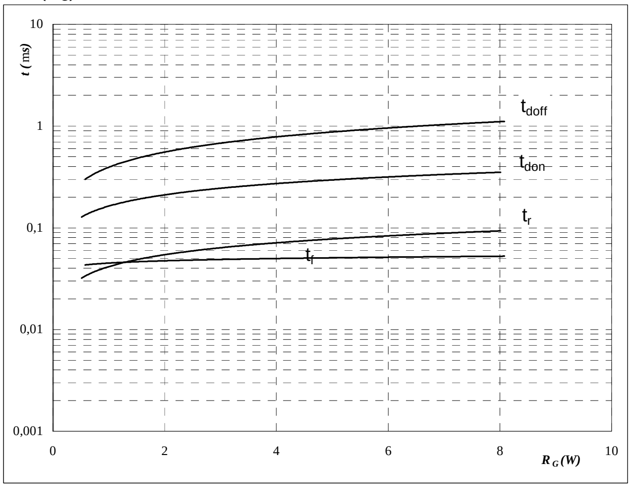
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	+15/-8	V
R_{gon} =	1	Ω
R_{goff} =	1	Ω

Figure 10 BOOST IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



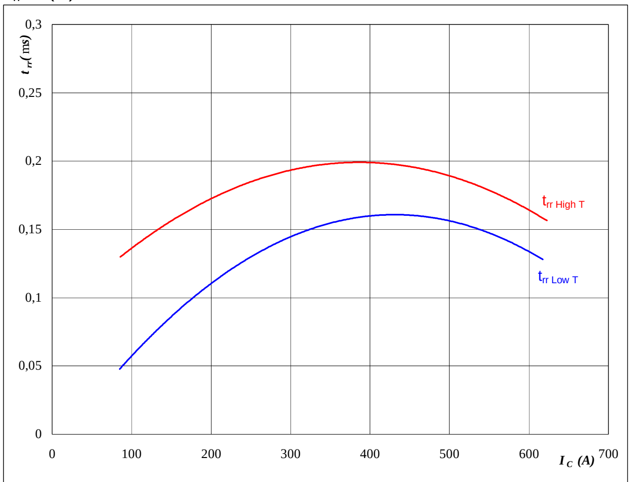
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	+15/-8	V
I_C =	414	A

Figure 11 BOOST FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(Ic)$



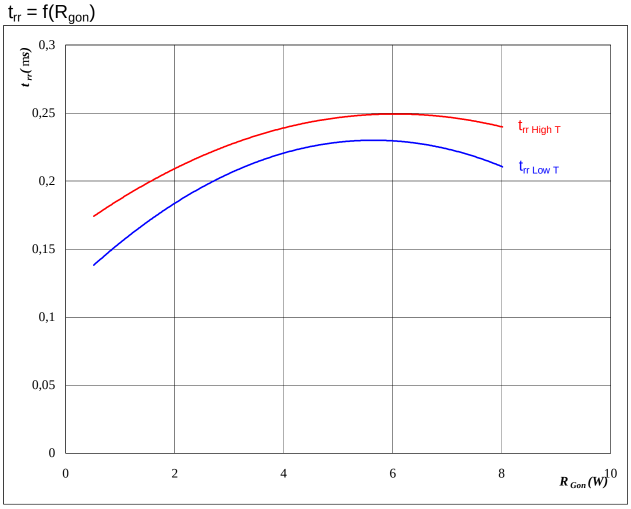
At

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	+15/-8	V
R_{gon} =	1	Ω

Figure 12 BOOST FWD

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

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



At

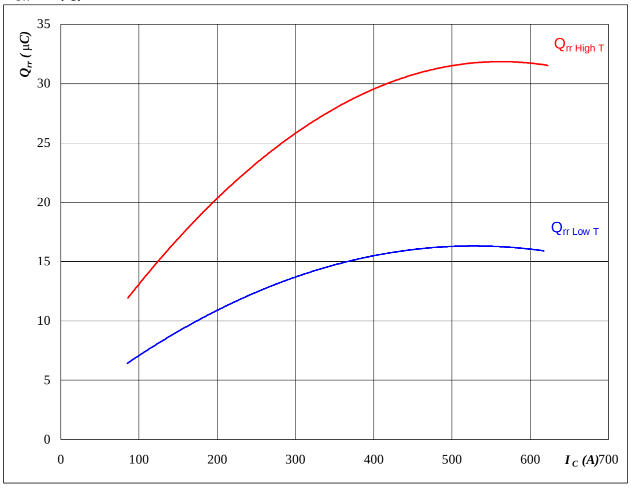
T_j =	25/125	°C
V_R =	400	V
I_F =	414	A
V_{GS} =	+15/-8	V

INPUT BOOST

Figure 13 BOOST FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



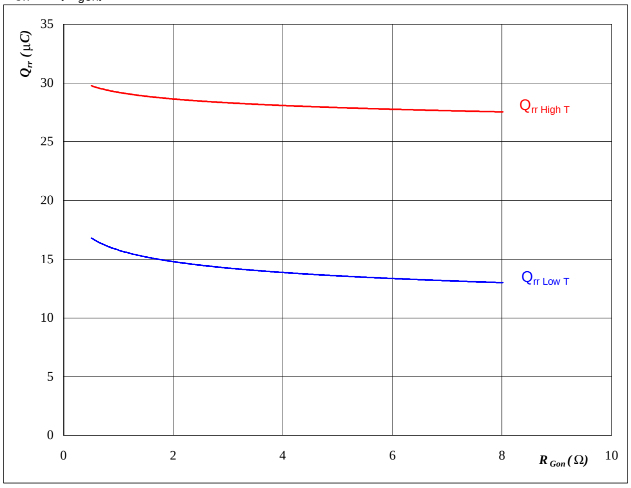
At

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	+15/-8	V
R_{gon} =	1	Ω

Figure 14 BOOST FWD

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

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



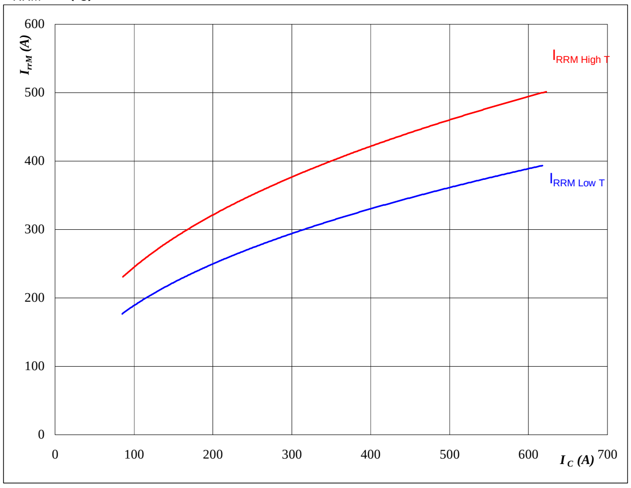
At

Tj =	25/125	°C
V_R =	400	V
I_F =	414	A
V_{GS} =	+15/-8	V

Figure 15 BOOST FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



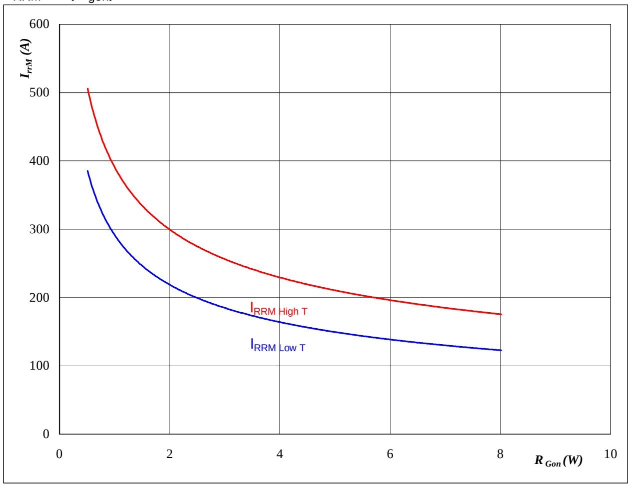
At

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	+15/-8	V
R_{gon} =	1	Ω

Figure 16 BOOST FWD

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

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



At

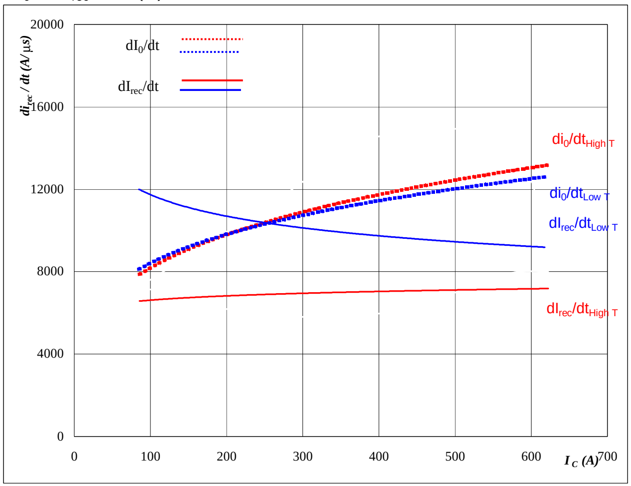
T_j =	25/125	°C
V_R =	400	V
I_F =	414	A
V_{GS} =	+15/-8	V

INPUT BOOST

Figure 17 BOOST FWD

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

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



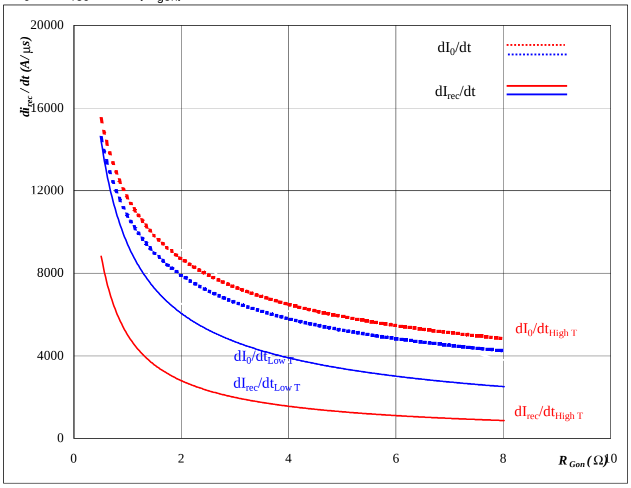
At

T_j =	25/125	°C
V_{CE} =	400	V
V_{GE} =	+15/-8	V
R_{gon} =	1	Ω

Figure 18 BOOST FWD

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

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



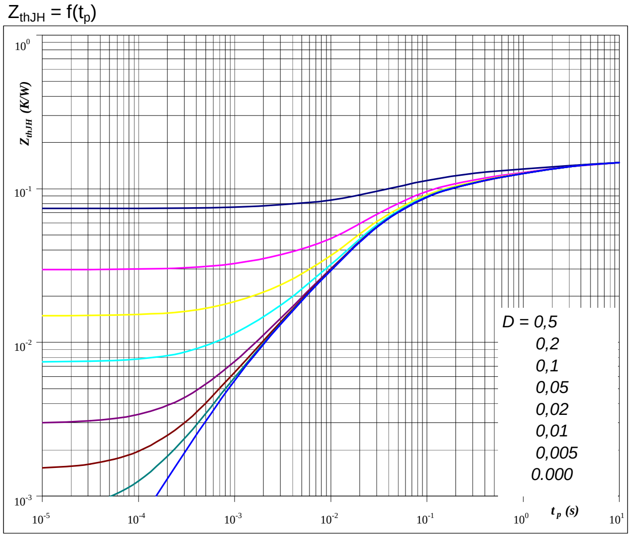
At

Tj =	25/125	°C
VR =	400	V
IF =	414	A
VGS =	+15/-8	V

Figure 19 BOOST IGBT

IGBT/MOSFET transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	0,15	K/W

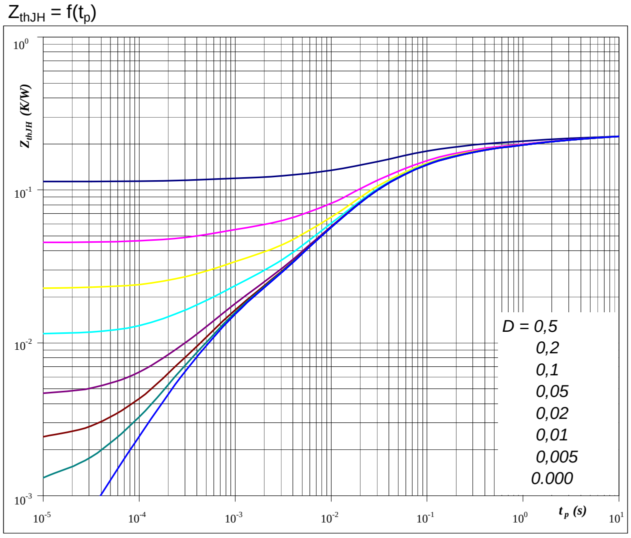
IGBT thermal model values

R (C/W)	Tau (s)
2,71E-02	2,96E+00
2,75E-02	4,85E-01
5,51E-02	6,48E-02
3,39E-02	1,60E-02
5,10E-03	1,36E-03
0,00E+00	0,00E+00

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} =	0,23	K/W

FWD thermal model values

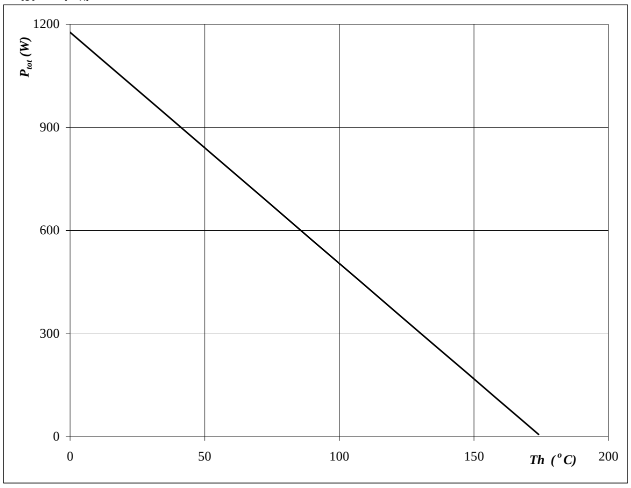
R (C/W)	Tau (s)
2,60E-02	4,70E+00
2,94E-02	8,50E-01
6,05E-02	1,28E-01
8,30E-02	2,59E-02
1,76E-02	5,35E-03
1,05E-02	5,51E-04

INPUT BOOST

Figure 21	BOOST IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



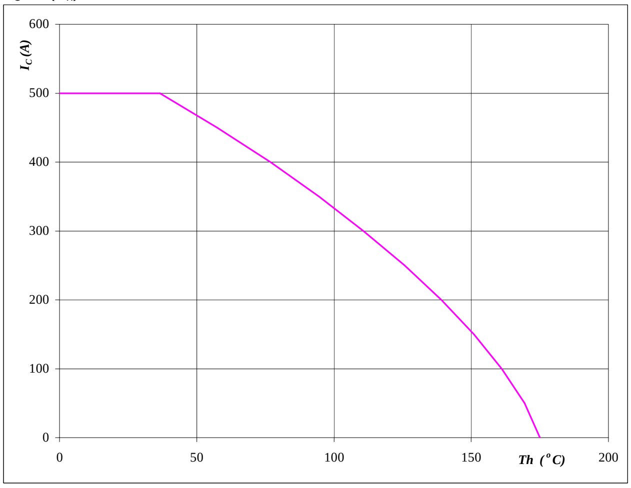
At

T_j = 175 ºC

Figure 22	BOOST IGBT

Collector/Drain current as a function of heatsink temperature

$I_C = f(T_h)$



At

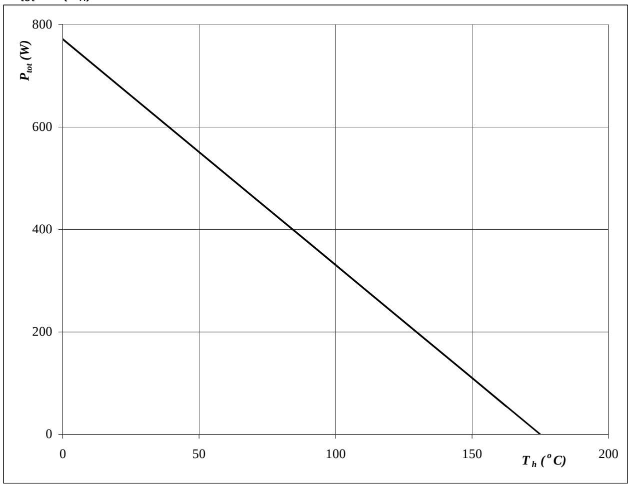
T_j = 175 ºC

V_{GS} = 15 V

Figure 23	BOOST FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



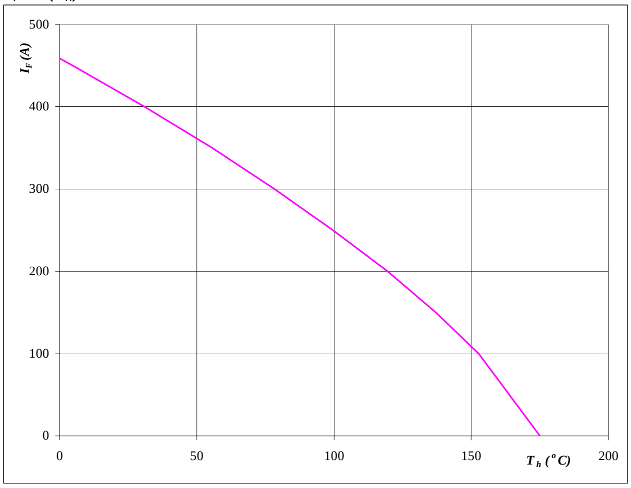
At

T_j = 175 ºC

Figure 24	BOOST FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

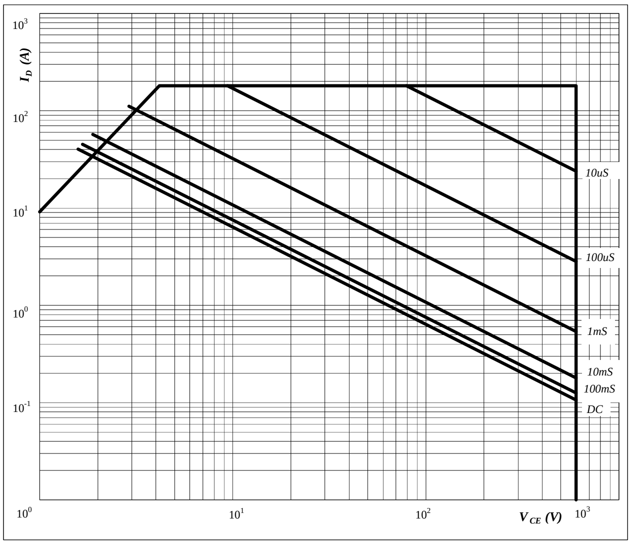
T_j = 175 ºC

INPUT BOOST

Figure 25 BOOST IGBT

Safe operating area as a function of drain-source voltage

$I_D = f(V_{DS})$



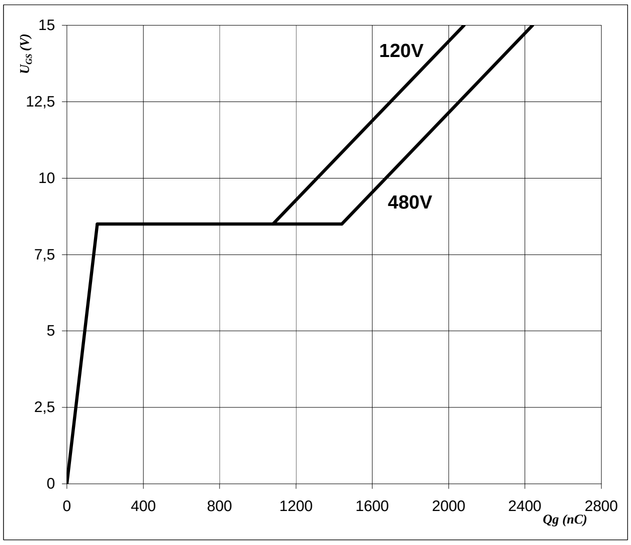
At

D =	single pulse	
T_h =	80	ºC
V_{GS} =	+15/-8	V
T_j =	T_{jmax}	ºC

Figure 26 BOOST IGBT

Gate voltage vs Gate charge

$V_{GS} = f(Qg)$



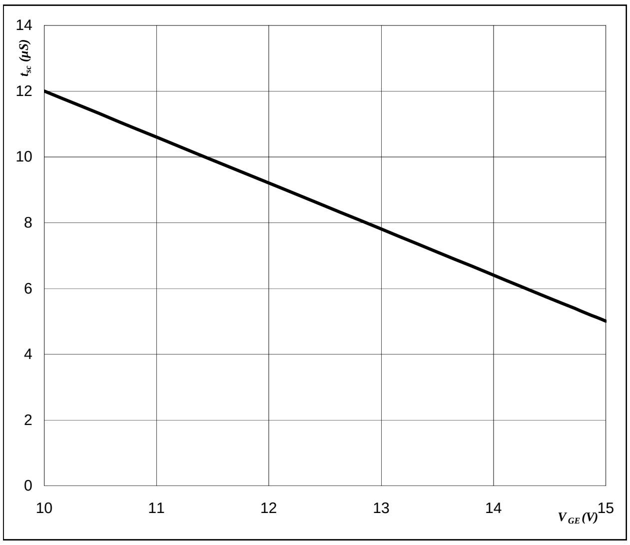
At

I_D =	400	A

Figure 27 Output inverter IGBT

Short circuit withstand time as a function of gate-emitter voltage

$t_{sc} = f(V_{GE})$



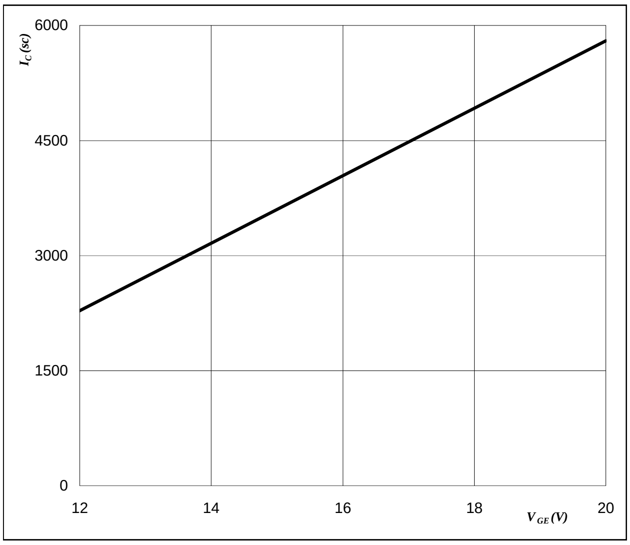
At

V_{CE} =	600	V
T_j ≤	150	ºC

Figure 28 Output inverter IGBT

Typical short circuit collector current as a function of gate-emitter voltage

$V_{GE} = f(Q_{GE})$



At

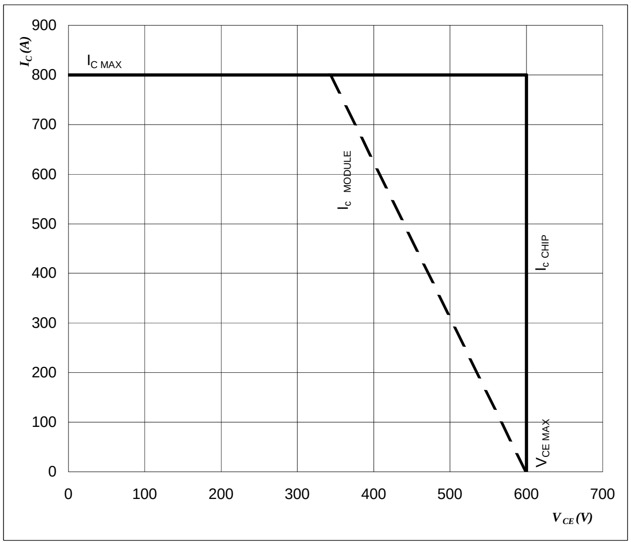
V_{CE} ≤	600	V
T_j =	150	ºC

INPUT BOOST

Figure 29 IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

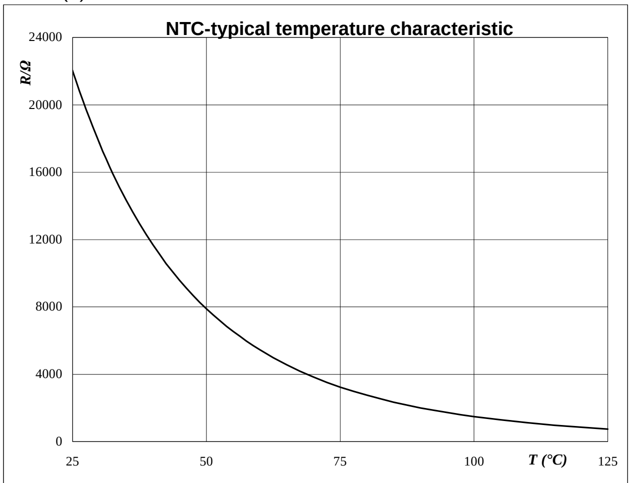
T_j =	T_{jmax}-25	ºC	R_{gon} =	0	Ω
$U_{ccminus}$=U_{ccplus}			R_{goff} =	0	Ω
Switching mode :		3 level switching			

Thermistor

Figure 1 Thermistor

Typical NTC characteristic
as a function of temperature

$R_T = f(T)$



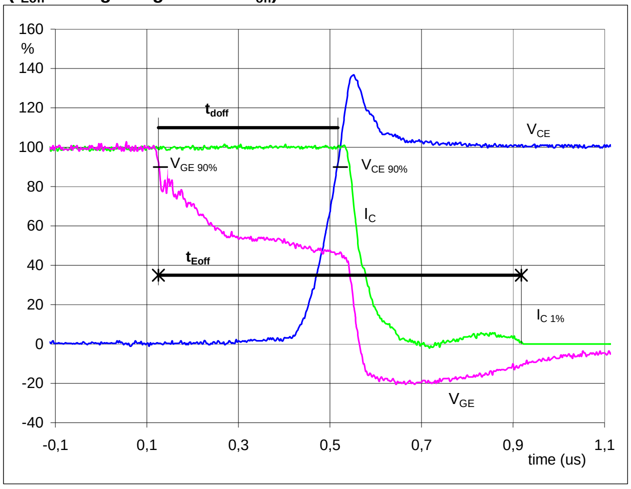
Switching Definitions Boost IGBT

General conditions

T_j	=	125 °C
R_{gon}	=	1 Ω
R_{goff}	=	1 Ω

Figure 1 Boost IGBT

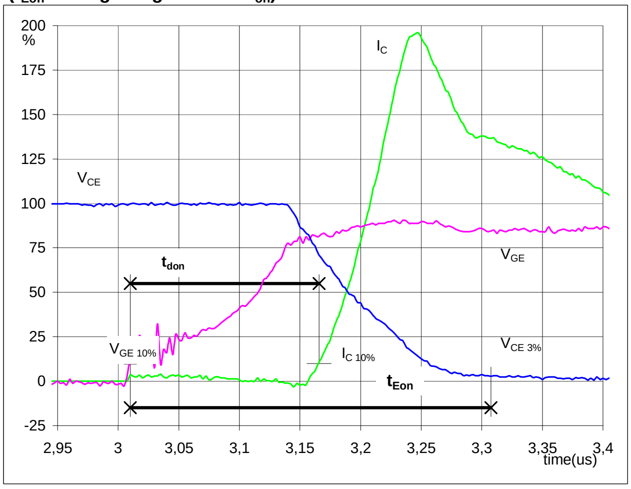
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	23	V
V_C (100%) =	400	V
I_C (100%) =	413	A
t_{doff} =	0,39	µs
t_{Eoff} =	0,79	µs

Figure 2 Boost IGBT

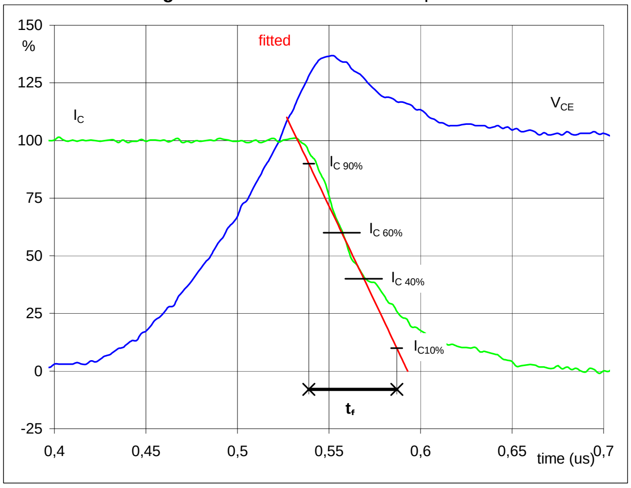
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	0	V
V_{GE} (100%) =	23	V
V_C (100%) =	400	V
I_C (100%) =	413	A
t_{don} =	0,16	µs
t_{Eon} =	0,30	µs

Figure 3 Boost IGBT

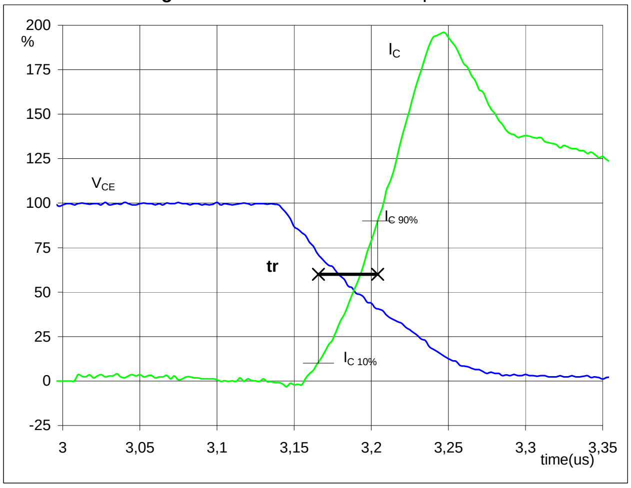
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	400	V
I_C (100%) =	413	A
t_f =	0,05	µs

Figure 4 Boost IGBT

Turn-on Switching Waveforms & definition of t_r

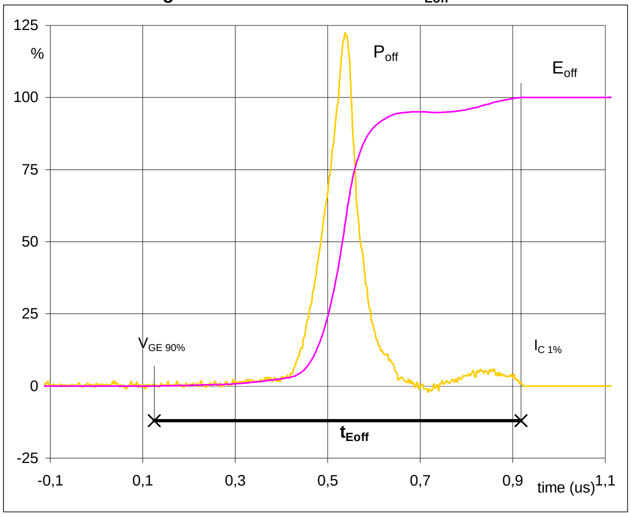


V_C (100%) =	400	V
I_C (100%) =	413	A
t_r =	0,04	µs

Switching Definitions Boost IGBT

Figure 5 Boost IGBT

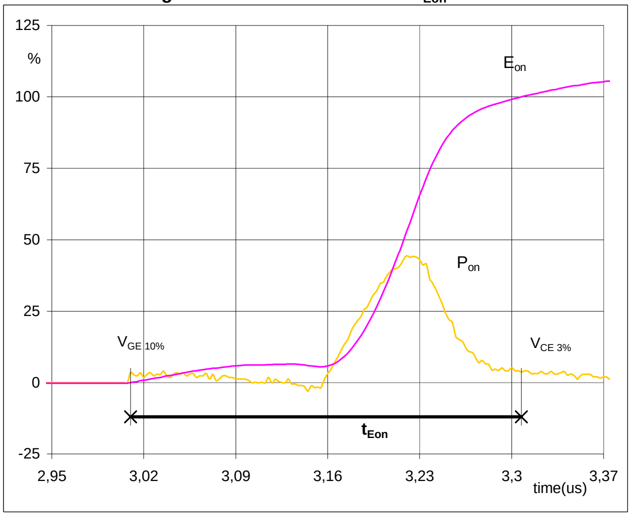
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) = 165,28 kW
E_{off} (100%) = 18,95 mJ
t_{Eoff} = 0,79 μs

Figure 6 Boost IGBT

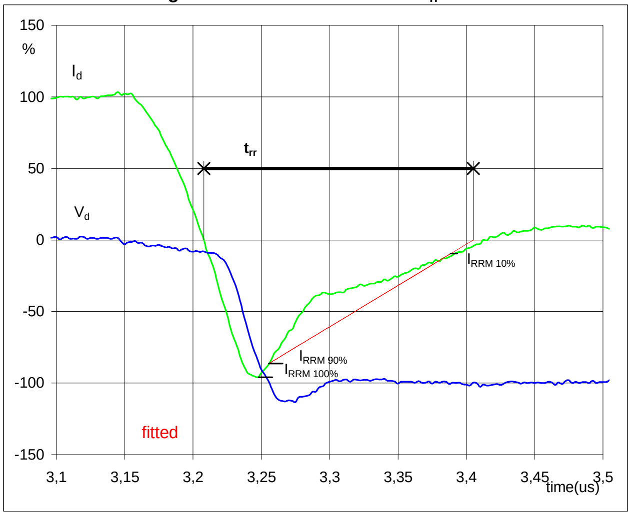
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) = 165,28 kW
E_{on} (100%) = 6,32 mJ
t_{Eon} = 0,30 μs

Figure 7 Boost IGBT

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

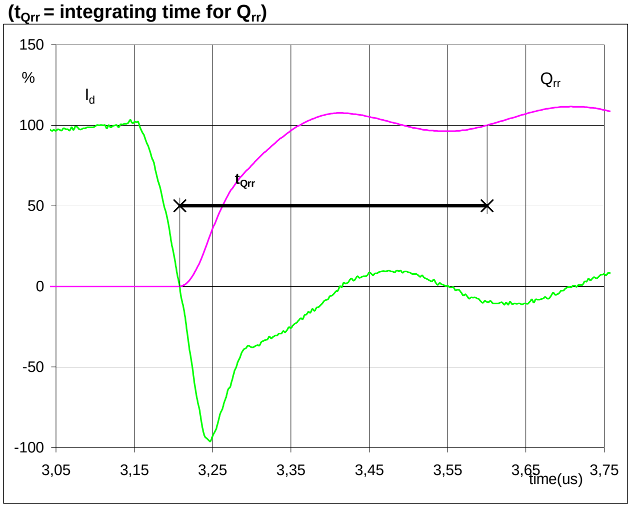


V_d (100%) = 400 V
I_d (100%) = 413 A
I_{RRM} (100%) = -398 A
t_{rr} = 0,20 μs

Switching Definitions Boost IGBT

Figure 8 Boost FWD

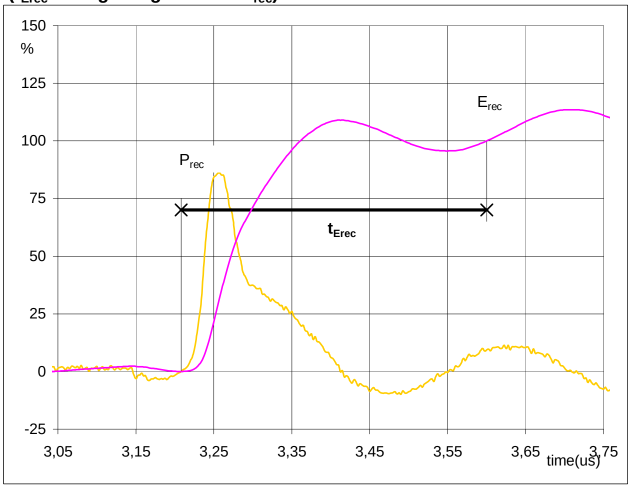
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	413	A
Q_{rr} (100%) =	30,70	μC
t_{Qrr} =	0,39	μs

Figure 9 Boost FWD

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



P_{rec} (100%) =	165,28	kW
E_{rec} (100%) =	10,48	mJ
t_{Erec} =	0,39	μs

Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

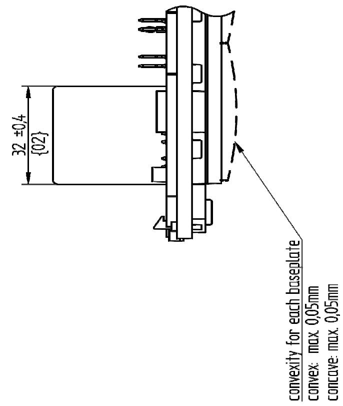
Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 12mm housing	70-W206NBA400SA-M786L	M786L	M786L

Outline

Driver pins				
Pin	X1	Y1	Function	Group
1.1	-11,75	59,65	T2C1	T2
1.2	30,25	59,65	T2C2	T2
1.3	1	62,65	G21	G2
1.4	43	62,65	G22	G2
1.5	1	59,65	E21	E2
1.6	43	59,65	E22	E2
1.7	-14,45	50,75	T3C1	T3
1.8	27,55	50,75	T3C2	T3
1.9	1	47,75	G31	G3
1.10	43	47,75	G32	G3
1.11	1	50,75	E31	E3
1.12	43	50,75	E32	E3
1.13	67,65	86,7	Th1	NTC
1.14	67,65	89,8	Th2	NTC

Power connections			
M6 screw	X2	Y2	Function
2.1	0	0	IN-
2.2	44	0	IN+
2.3	0	110,4	DC-
2.4	22	110,4	GND
2.5	44	110,4	DC+

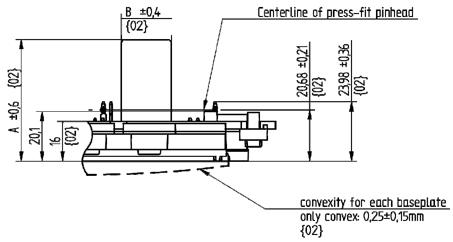
Low current connections			
M4 screw	X3	Y3	Function
3.1	-37,4	89,8	DC+
3.2	81,4	89,8	DC+
3.3	-37,4	65,2	IN+
3.4	81,4	65,2	IN+
3.5	-37,4	45,2	IN-
3.6	81,4	45,2	IN-
3.7	-37,4	20,6	DC-
3.8	81,4	20,6	DC-

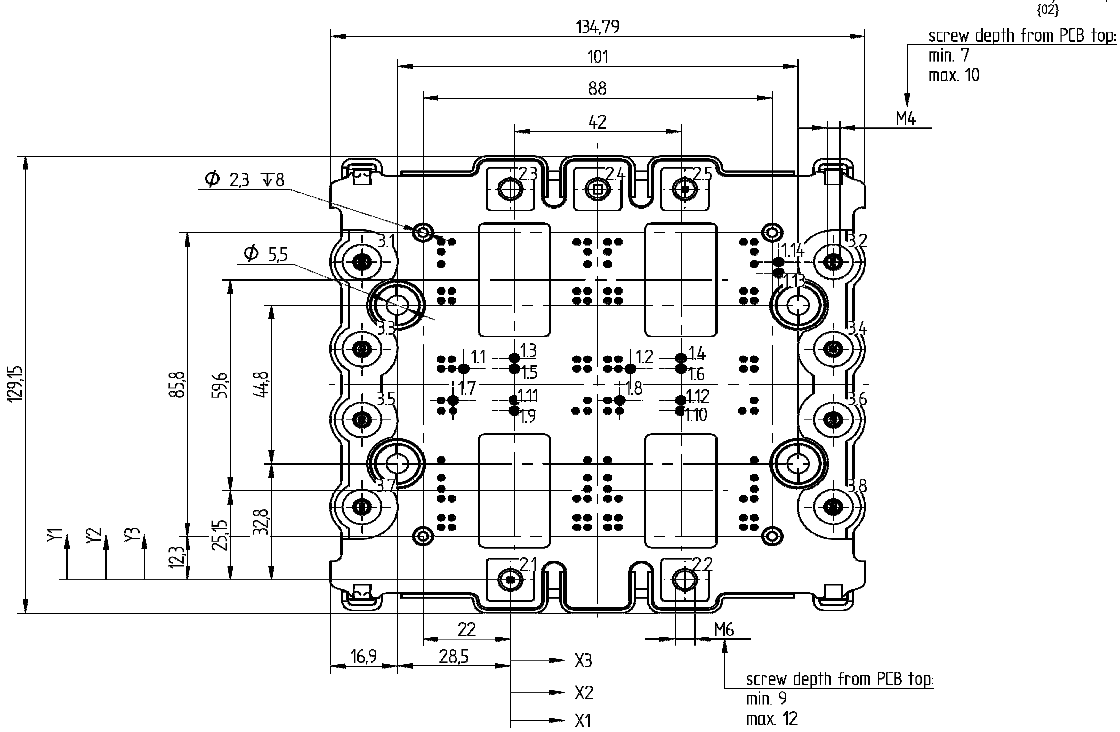


Tolerance of pinpositions: ±0,3mm at the end of pins
PCB holes and connection parameters of pins see in the handling instruction document

{02}

Module type	dim. A	dim. B
M786L	40,5	15
M788L	49	18

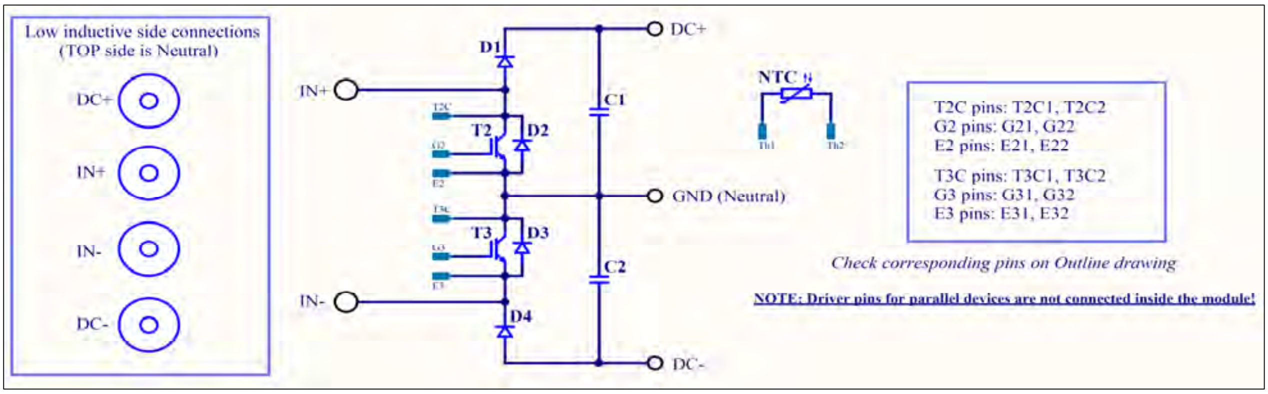




Ordering Code and Marking - Outline - Pinout

Pinout

70-W206NBA400SA-M786L



DISCLAIMER

The information given in this datasheet describes the type of component and does not represent assured characteristics. For tested values please contact Vincotech.Vincotech reserves the right to make changes without further notice to any products herein to improve reliability, function or design. Vincotech does not assume any liability arising out of the application or use of any product or circuit described herein; neither does it convey any license under its patent rights, nor the rights of others.

LIFE SUPPORT POLICY

Vincotech products are not authorised for use as critical components in life support devices or systems without the express written approval of Vincotech.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.

2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.