











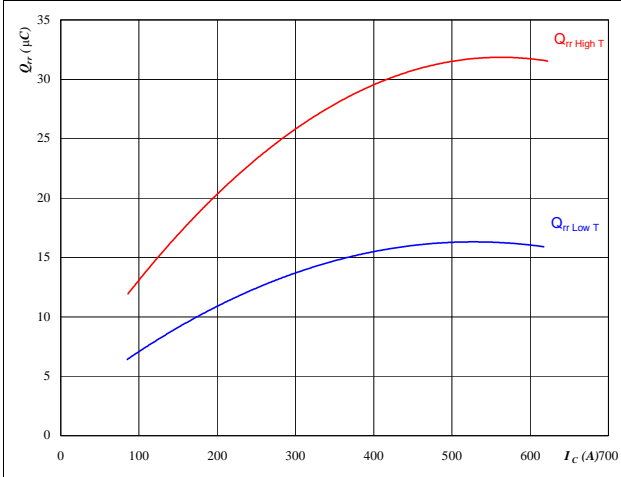




## INPUT BOOST

**Figure 13** BOOST FWD
**Typical reverse recovery charge as a function of collector current**

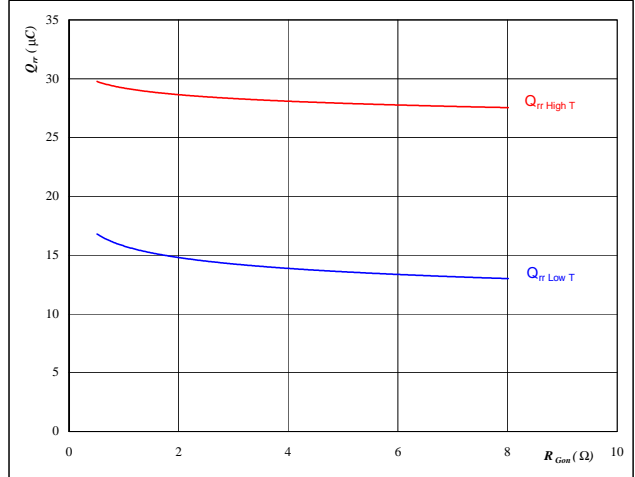
$$Q_{rr} = f(I_C)$$



**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**

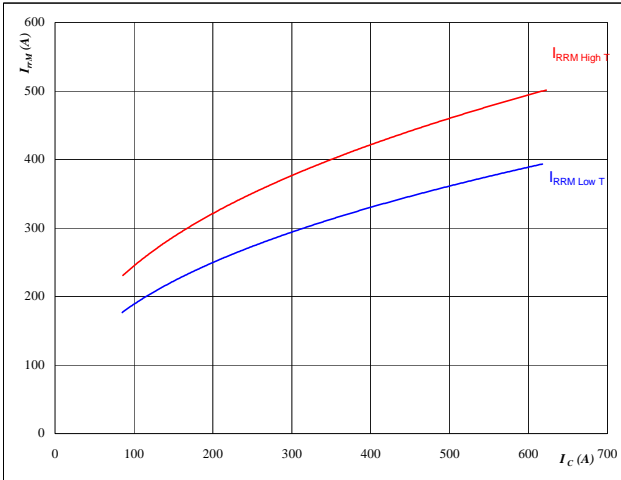
$$Q_{rr} = f(R_{gon})$$



**At**  
 $T_j = 25/125$  °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**

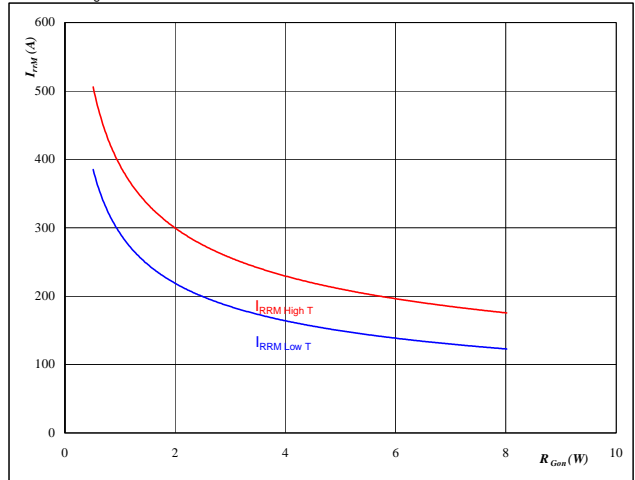
$$I_{RRM} = f(I_C)$$



**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

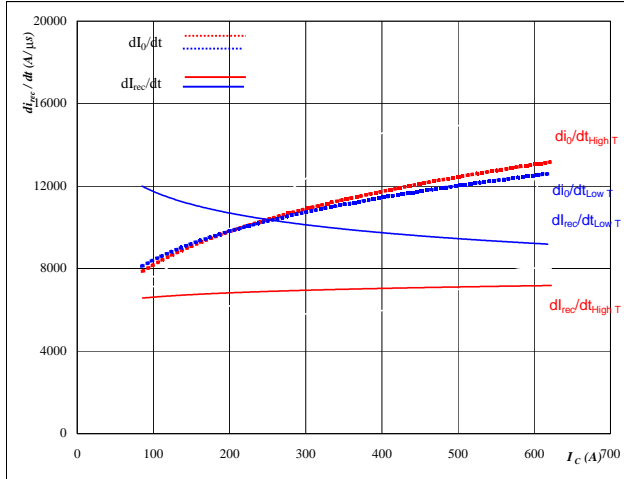


## INPUT BOOST

Figure 17 BOOST FWD

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

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

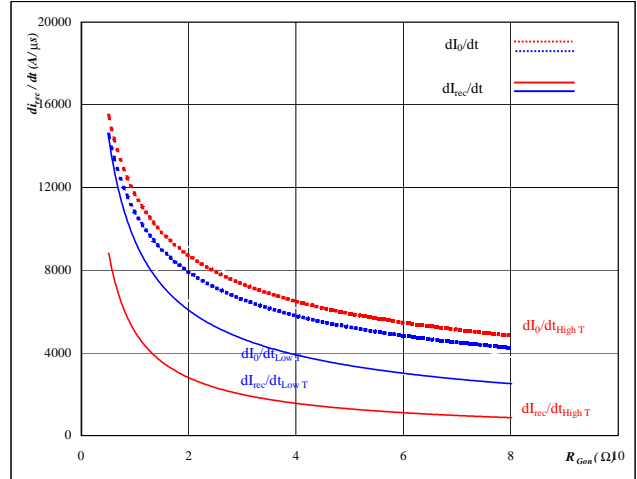


At  
 $T_j = 25/125 \text{ } ^\circ\text{C}$   
 $V_{CE} = 400 \text{ V}$   
 $V_{GE} = +15/-8 \text{ V}$   
 $R_{gon} = 1 \text{ } \Omega$

Figure 18 BOOST FWD

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

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

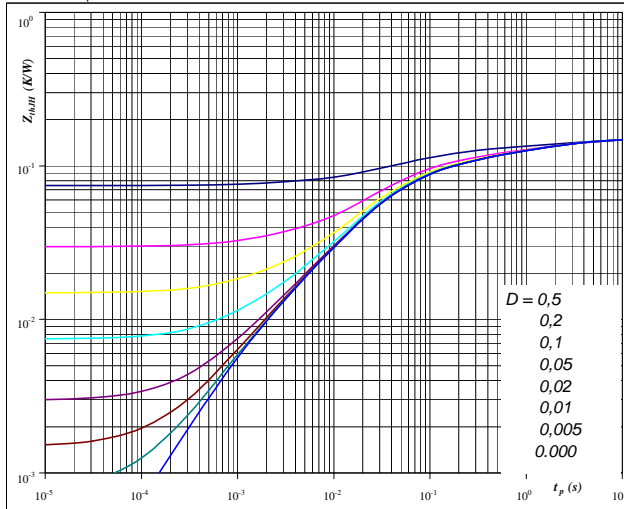


At  
 $T_j = 25/125 \text{ } ^\circ\text{C}$   
 $V_R = 400 \text{ V}$   
 $I_F = 414 \text{ A}$   
 $V_{GS} = +15/-8 \text{ V}$

Figure 19 BOOST IGBT

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

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



At  
 $D = t_p / T$   
 $R_{thJH} = 0,15 \text{ K/W}$

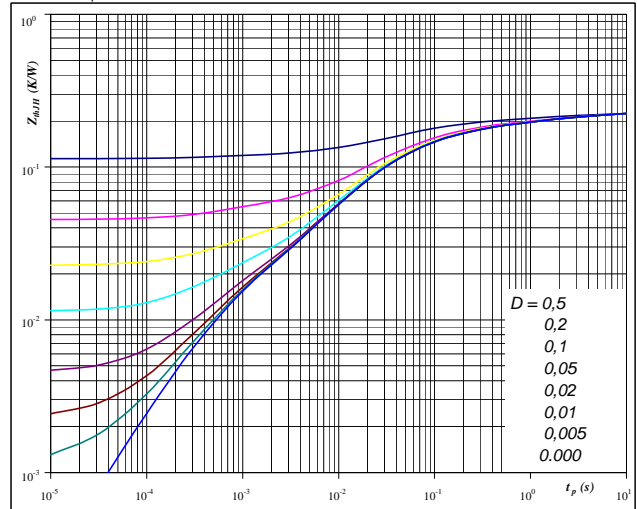
IGBT thermal model values

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  
 $D = t_p / T$   
 $R_{thJH} = 0,23 \text{ K/W}$

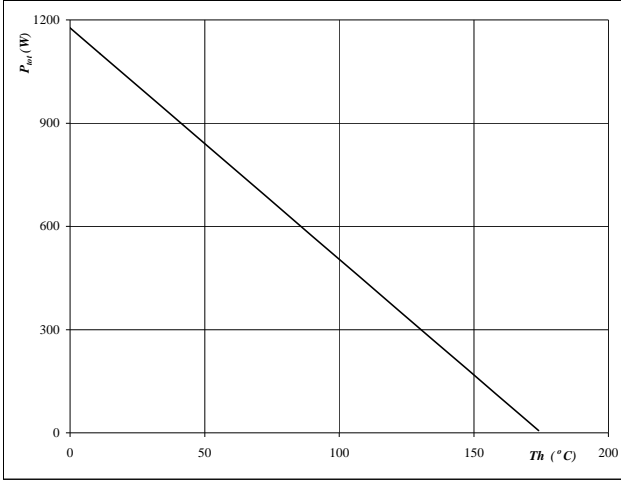
FWD thermal model values

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

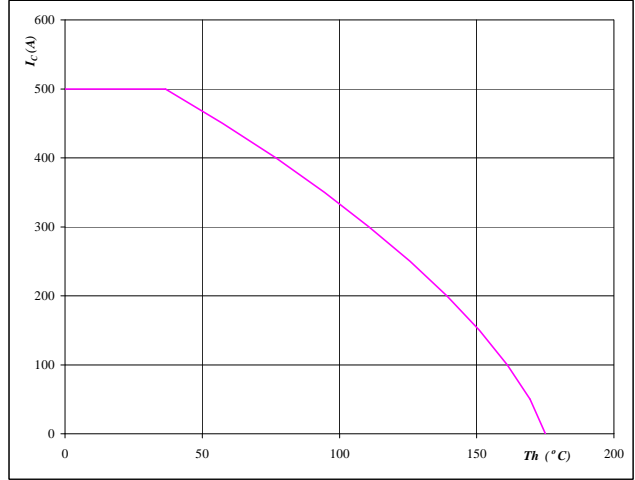
## INPUT BOOST

**Figure 21** BOOST IGBT
**Power dissipation as a function of heatsink temperature**

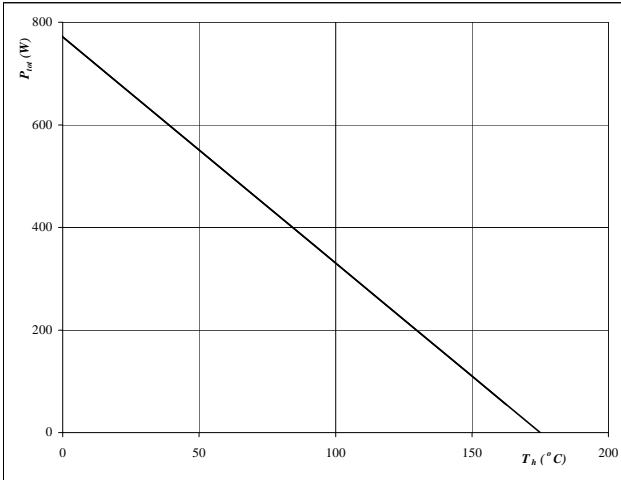
$$P_{tot} = f(T_h)$$


**At**  
 $T_j = 175 \text{ } ^\circ\text{C}$ 
**Figure 22** BOOST IGBT
**Collector/Drain current as a function of heatsink temperature**

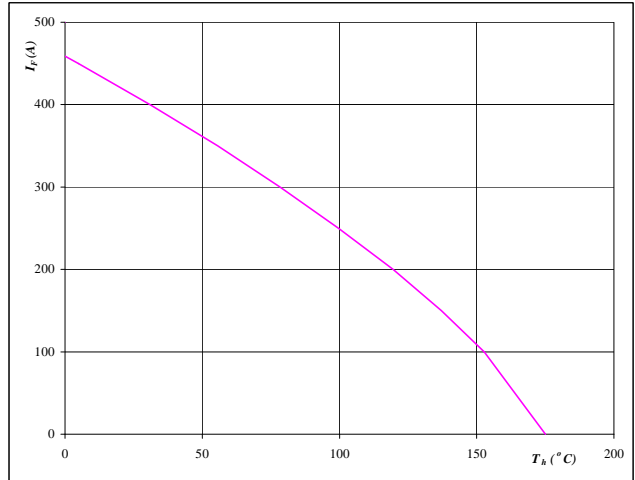
$$I_C = f(T_h)$$


**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**

$$I_F = f(T_h)$$

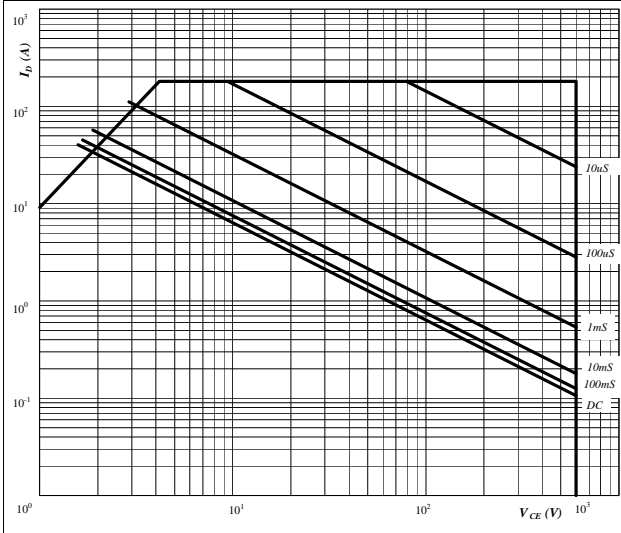

**At**  
 $T_j = 175 \text{ } ^\circ\text{C}$

## INPUT BOOST

**Figure 25** BOOST IGBT

**Safe operating area as a function of drain-source voltage**

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

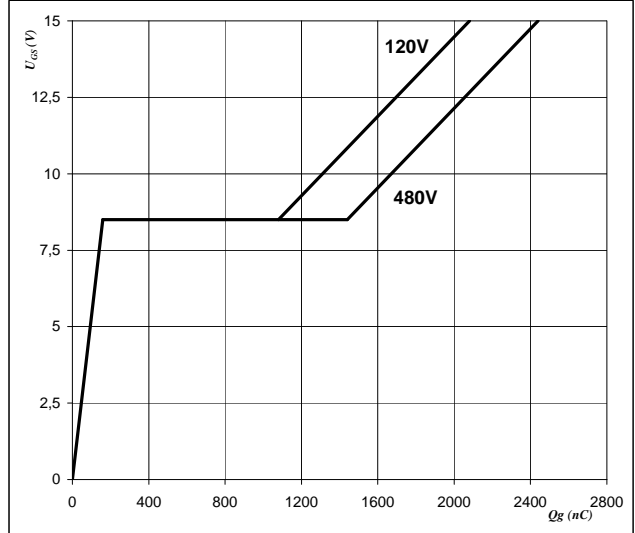


**At**  
 D = single pulse  
 $T_h = 80$  °C  
 $V_{GS} = +15/-8$  V  
 $T_j = T_{jmax}$  °C

**Figure 26** BOOST IGBT

**Gate voltage vs Gate charge**

$$V_{GS} = f(Q_g)$$

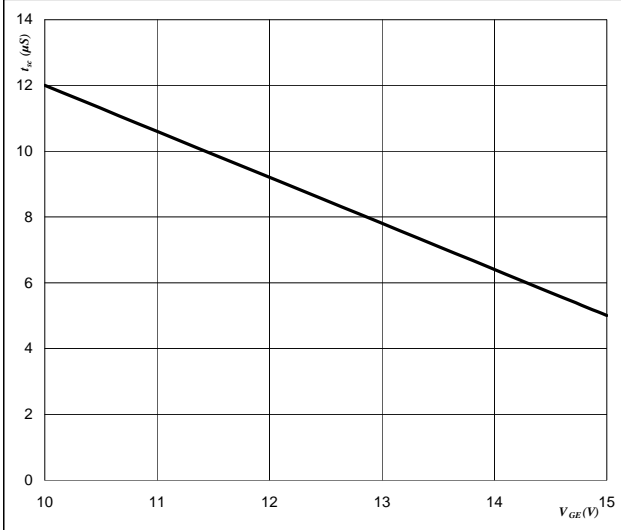


**At**  
 $I_D = 400$  A

**Figure 27** Output inverter IGBT

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

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

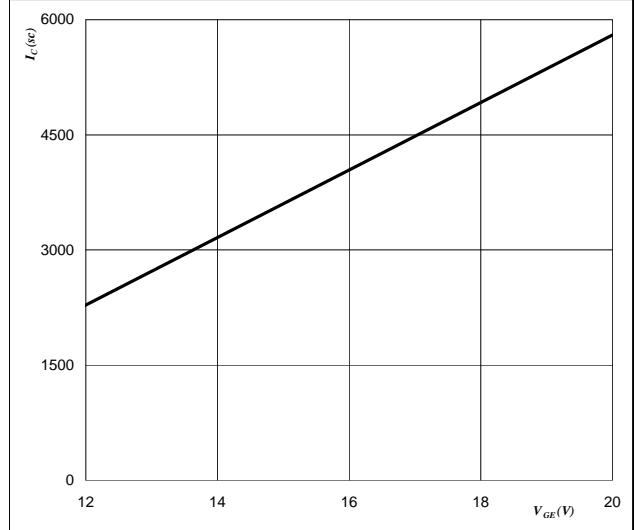


**At**  
 $V_{CE} = 600$  V  
 $T_j \leq 150$  °C

**Figure 28** Output inverter IGBT

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

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



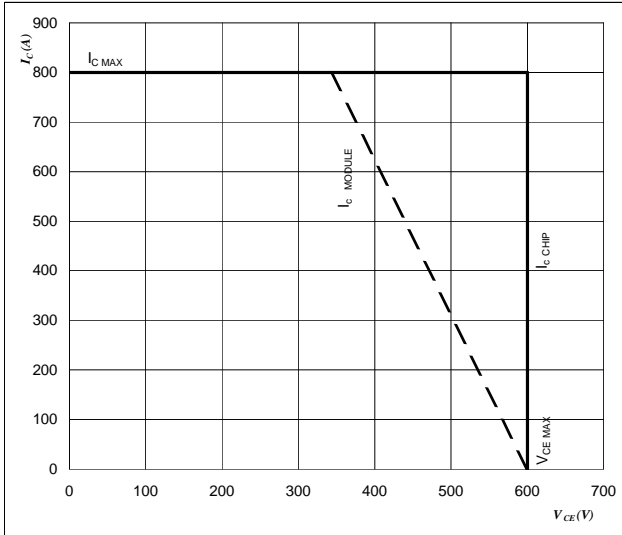
**At**  
 $V_{CE} \leq 600$  V  
 $T_j = 150$  °C

## INPUT BOOST

**Figure 29** IGBT

**Reverse bias safe operating area**

$$I_C = f(V_{CE})$$



**At**

$$T_J = T_{jmax} - 25 \text{ } ^\circ\text{C} \quad R_{gon} = 0 \quad \Omega$$

$$U_{ocminus} = U_{ccplus} \quad R_{goff} = 0 \quad \Omega$$

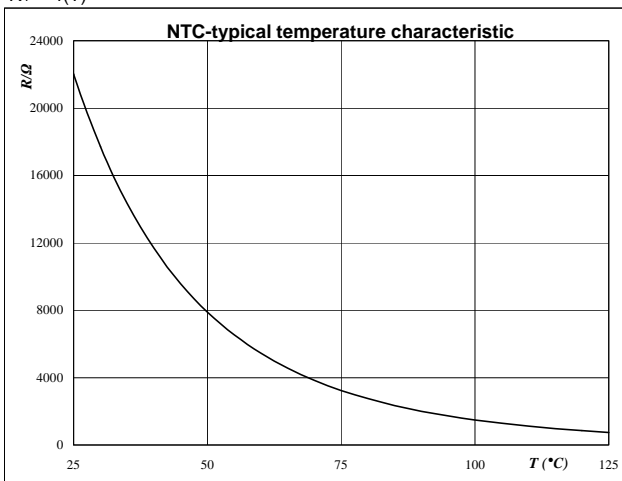
Switching mode : 3 level switching

## Thermistor

**Figure 1** Thermistor

**Typical NTC characteristic  
as a function of temperature**

$$R_T = f(T)$$

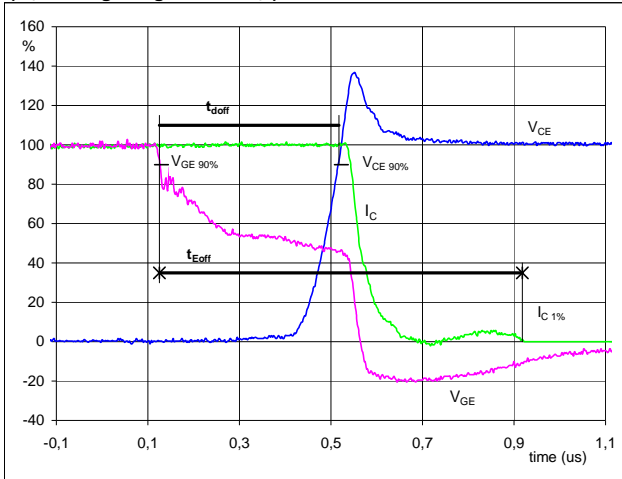


### Switching Definitions Boost IGBT

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

Figure 1 Boost IGBT

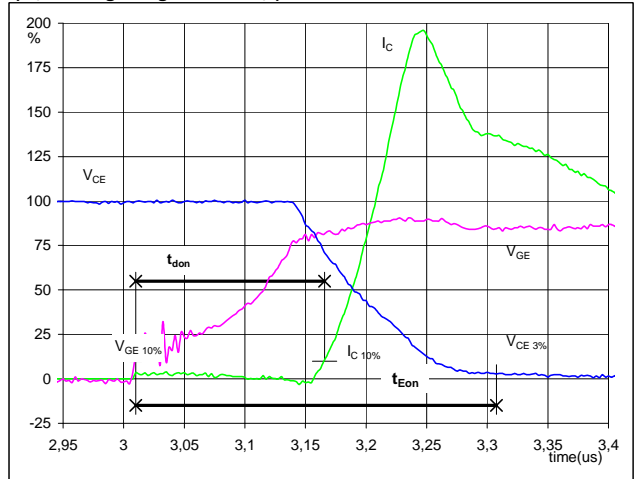
Turn-off Switching Waveforms & definition of  $t_{doff}$ ,  $t_{Eoff}$   
 ( $t_{Eoff}$  = integrating time for  $E_{off}$ )



$V_{GE}(0\%) =$	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

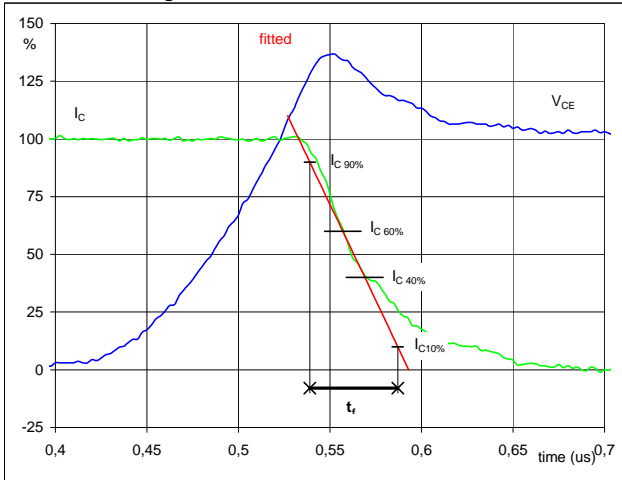
Turn-on Switching Waveforms & definition of  $t_{don}$ ,  $t_{Eon}$   
 ( $t_{Eon}$  = integrating time for  $E_{on}$ )



$V_{GE}(0\%) =$	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

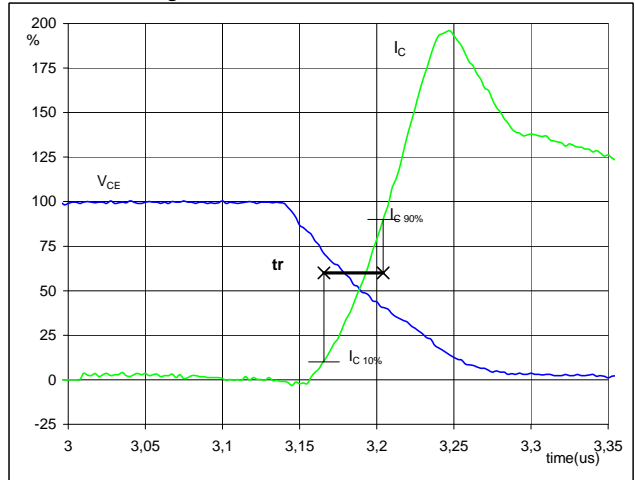
Turn-off Switching Waveforms & definition of  $t_f$



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

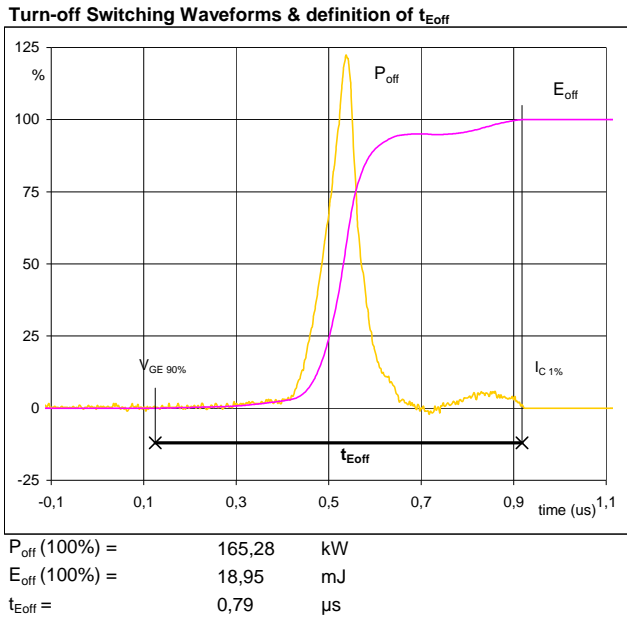
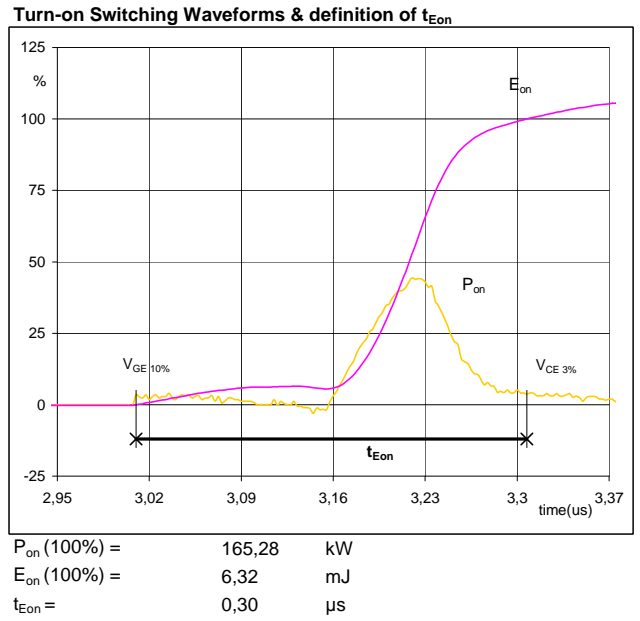
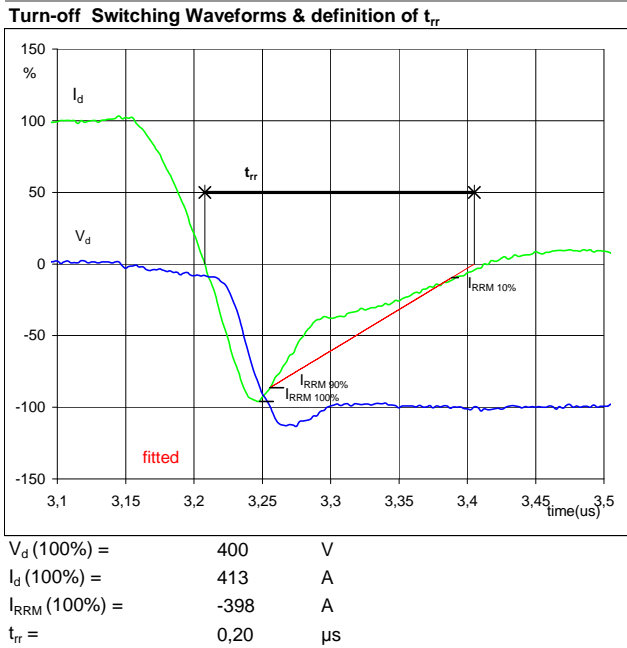
Figure 4 Boost IGBT

Turn-on Switching Waveforms & definition of  $t_r$



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

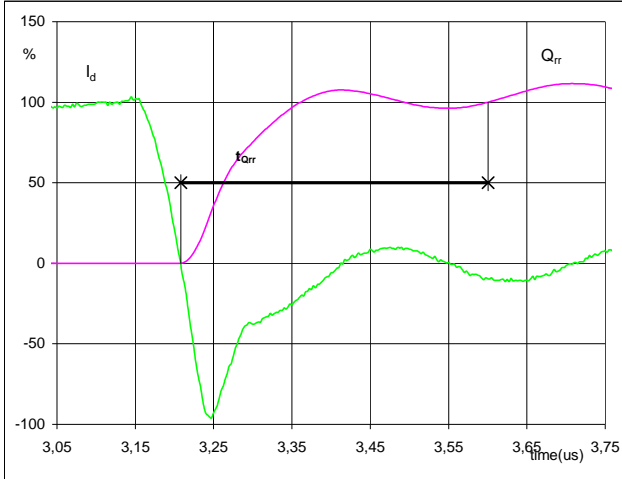
## Switching Definitions Boost IGBT

**Figure 5** Boost IGBT

**Figure 6** Boost IGBT

**Figure 7** Boost IGBT


## Switching Definitions Boost IGBT

**Figure 8** Boost FWD

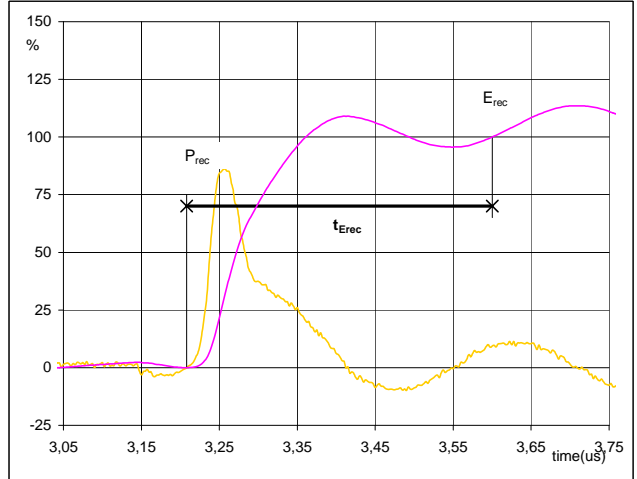
Turn-on Switching Waveforms & definition of  $t_{Qrr}$   
 ( $t_{Qrr}$  = integrating time for  $Q_{rr}$ )



$I_d$ (100%) =	413	A
$Q_{rr}$ (100%) =	30,70	$\mu\text{C}$
$t_{Qrr}$ =	0,39	$\mu\text{s}$

**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	$\mu\text{s}$

### 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

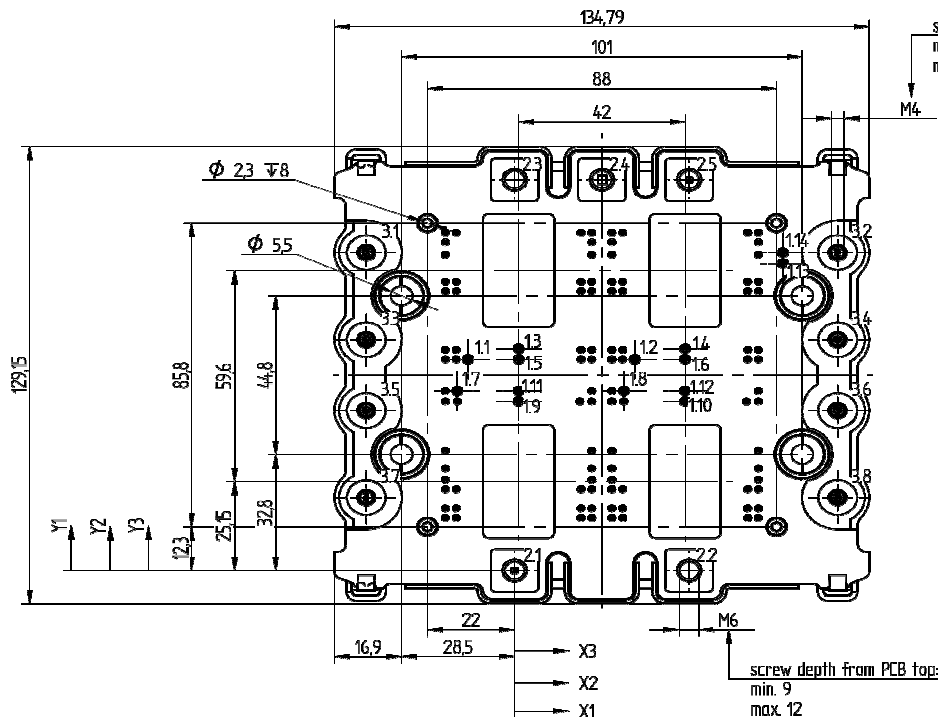
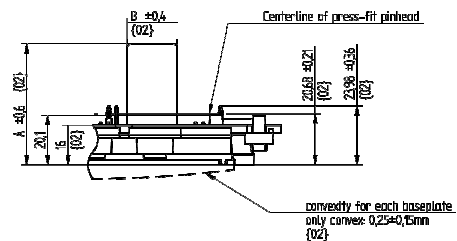
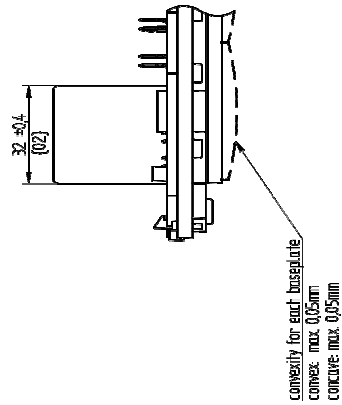
Driver pins				
Pin	X1	Y1	Function	Group
1.1	-11,75	59,65	T2C1	T2
1.2	30,25	59,65	T2C2	T2
1.3	1	62,65	G21	G2
1.4	43	62,65	G22	G2
1.5	1	59,65	E21	E2
1.6	43	59,65	E22	E2
1.7	-14,45	50,75	T3C1	T3
1.8	27,55	50,75	T3C2	T3
1.9	1	47,75	G31	G3
1.10	43	47,75	G32	G3
1.11	1	50,75	E31	E3
1.12	43	50,75	E32	E3
1.13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

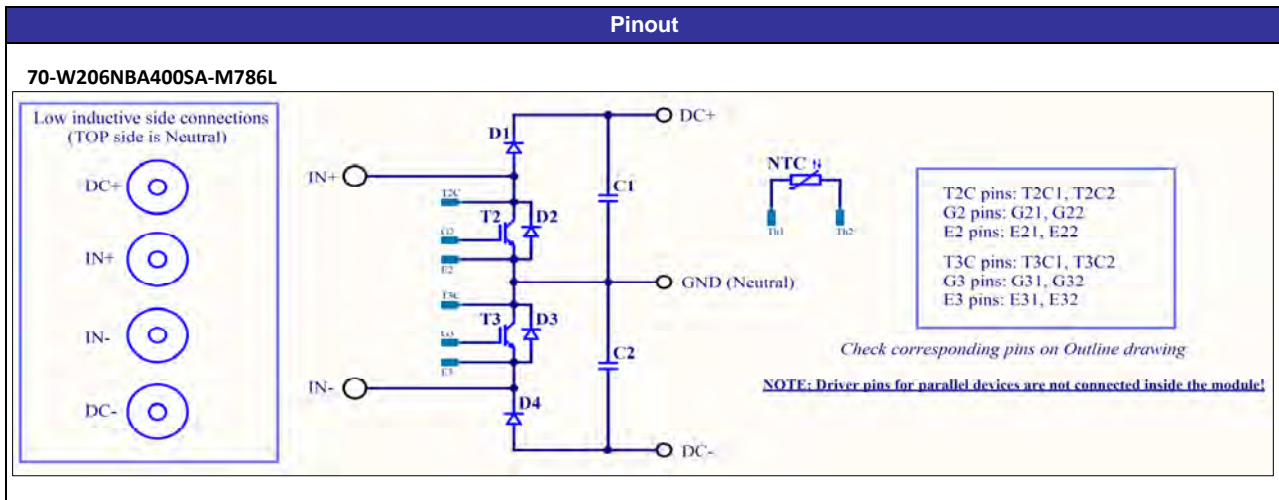
Low current connections			
M4 screw	X3	Y3	Function
3.1	-37,4	89,8	DC+
3.2	81,4	89,8	DC+
3.3	-37,4	65,2	IN+
3.4	81,4	65,2	IN+
3.5	-37,4	45,2	IN-
3.6	81,4	45,2	IN-
3.7	-37,4	20,6	DC-
3.8	81,4	20,6	DC-

Tolerance of pinpositions:  $\pm 0,3\text{mm}$  at the end of pins  
PCB holes and connection parameters of pins see in the handling instruction document

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





**Ordering Code and Marking - Outline - Pinout**


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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.