

*flow*BOOST 0

600 V/84 A PS\*

**Features**

- \*PS: 2x84A parallel switch (75A IGBT and 99mΩ C6)
- ultrafast IGBT with C6 MOSFET and ultrafast buck diodes
- high efficiency dual booster
- ultra fast switching frequency
- low inductance layout

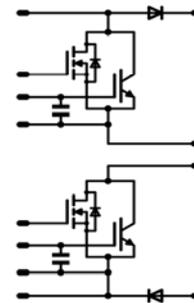
**Target Applications**

- solar inverter
- UPS

**Types**

- 10-FZ06NBA084FP10-M306L38

**flow 0 12mm housing**

**Schematic**


## Maximum Ratings

 T<sub>j</sub>=25°C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
<b>Input Boost IGBT</b>				
Collector-emitter break down voltage	V <sub>CE</sub>		600	V
DC collector current	I <sub>C</sub>	T <sub>j</sub> =T <sub>jmax</sub> T <sub>n</sub> =80°C T <sub>c</sub> =80°C	58 76	A
Repetitive peak collector current	I <sub>Cpulse</sub>	t <sub>p</sub> limited by T <sub>jmax</sub>	225	A
Power dissipation per IGBT	P <sub>tot</sub>	T <sub>j</sub> =T <sub>jmax</sub> T <sub>n</sub> =80°C T <sub>c</sub> =80°C	111 169	W
Gate-emitter peak voltage	V <sub>GE</sub>		±20	V
Short circuit ratings	t <sub>SC</sub> V <sub>CC</sub>	T <sub>j</sub> ≤125°C V <sub>GE</sub> =15V	9 360	μs V
Maximum Junction Temperature	T <sub>jmax</sub>		175	°C

**Input Boost FWD**

Peak Repetitive Reverse Voltage	V <sub>RRM</sub>	T <sub>j</sub> =25°C	600	V
DC forward current	I <sub>F</sub>	T <sub>j</sub> =T <sub>jmax</sub> T <sub>n</sub> =80°C T <sub>c</sub> =80°C	89 119	A
Repetitive peak forward current	I <sub>FRM</sub>	t <sub>p</sub> limited by T <sub>jmax</sub>	240	A
Power dissipation per Diode	P <sub>tot</sub>	T <sub>j</sub> =T <sub>jmax</sub> T <sub>n</sub> =80°C T <sub>c</sub> =80°C	106 160	W
Maximum Junction Temperature	T <sub>jmax</sub>		175	°C

## Maximum Ratings

 T<sub>j</sub>=25°C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit	
<b>Input Boost MOSFET</b>					
Drain to source breakdown voltage	V <sub>DS</sub>		600	V	
DC drain current	I <sub>D</sub>	T <sub>j</sub> =T <sub>jmax</sub>	T <sub>h</sub> =80°C	18	A
			T <sub>c</sub> =80°C	22	
Pulsed drain current	I <sub>Dpulse</sub>	t <sub>p</sub> limited by T <sub>jmax</sub>	112	A	
Power dissipation	P <sub>tot</sub>	T <sub>j</sub> =T <sub>jmax</sub>	T <sub>h</sub> =80°C	67	W
			T <sub>c</sub> =80°C	101	
Gate-source peak voltage	V <sub>gs</sub>		±20	V	
Maximum Junction Temperature	T <sub>jmax</sub>		150	°C	

### Thermal Properties

Storage temperature	T <sub>stg</sub>		-40...+125	°C
Operation temperature under switching condition	T <sub>op</sub>		-40...+(T <sub>jmax</sub> - 25)	°C

### Insulation Properties

Insulation voltage	V <sub>is</sub>	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		
<b>Input Boost IGBT *</b>										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,00025	$T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$	3,5	5	6	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		75	$T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$	1	1,95 2,11	2,8	V
Collector-emitter cut-off current incl. Diode	$I_{CES}$		0	600		$T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$			250	$\mu\text{A}$
Gate-emitter leakage current	$I_{GES}$		20	0		$T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$			500	nA
Integrated Gate resistor	$R_{gint}$							none		$\Omega$
Input capacitance	$C_{ies}$							3800		pF
Output capacitance	$C_{oss}$	f=1MHz	0	30		$T_j=25^\circ\text{C}$		390		pF
Reverse transfer capacitance	$C_{rss}$							105		pF
Gate charge	$Q_{Gate}$		$\pm 15$	400	75	$T_j=25^\circ\text{C}$		248		nC
Thermal resistance chip to heatsink per chip	$R_{thJH}$	Thermal grease thickness $\leq 50\mu\text{m}$						0,85		K/W
Thermal resistance chip to case per chip	$R_{thJC}$	$\lambda = 1 \text{ W/mK}$						0,56		K/W

\* see dynamic characteristic at MosFET

**Input Boost FWD**

Diode forward voltage	$V_F$				70	$T_j=25^\circ\text{C}$ $T_j=125^\circ\text{C}$	1	1,92 1,51	2,7	V
Peak reverse recovery current	$I_{RRM}$	$R_{gon}=8 \Omega$	$\pm 15$	350	70	$T_j=25^\circ\text{C}$ $T_j=125^\circ\text{C}$		89 121		A
Reverse recovery time	$t_{rr}$					$T_j=25^\circ\text{C}$ $T_j=125^\circ\text{C}$		29 68		ns
Reverse recovered charge	$Q_{rr}$					$T_j=25^\circ\text{C}$ $T_j=125^\circ\text{C}$		1,71 4,38		$\mu\text{C}$
Peak rate of fall of recovery current	$di(rec)_{max}/dt$					$T_j=25^\circ\text{C}$ $T_j=125^\circ\text{C}$		9405 3992		A/ $\mu\text{s}$
Reverse recovered energy	$E_{rec}$					$T_j=25^\circ\text{C}$ $T_j=125^\circ\text{C}$		0,36 0,85		mWs
Thermal resistance chip to heatsink per chip	$R_{thJH}$	Thermal grease thickness $\leq 50\mu\text{m}$						0,90		K/W
Thermal resistance chip to case per chip	$R_{thJC}$	$\lambda = 1 \text{ W/mK}$						0,59		K/W

**Characteristic Values**

Parameter	Symbol	Conditions					Value			Unit
		$V_{GE}$ [V] or $V_{GS}$ [V]	$V_c$ [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		
<b>Input Boost MOSFET</b>										
Static drain to source ON resistance	$R_{ds(on)}$		10		18,1	$T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$		90 230		m $\Omega$
Gate threshold voltage	$V_{(GS)th}$		$V_{DS}=V_{GS}$		0,0024	$T_j=25^\circ\text{C}$ $T_j=125^\circ\text{C}$	2,4	3	3,6	V
Gate to Source Leakage Current	$I_{gss}$		20	0		$T_j=25^\circ\text{C}$ $T_j=125^\circ\text{C}$			100	nA
Zero Gate Voltage Drain Current	$I_{dss}$		0	600		$T_j=25^\circ\text{C}$ $T_j=125^\circ\text{C}$			5000	nA
Turn On Delay Time	$t_{d(ON)}$	Rgoff=8 $\Omega$ Rgon=8 $\Omega$	15/0	350	70	$T_j=25^\circ\text{C}$ $T_j=125^\circ\text{C}$	17 17			ns
Rise Time	$t_r$					$T_j=25^\circ\text{C}$ $T_j=125^\circ\text{C}$	9 10,4			
Turn off delay time	$t_{d(OFF)}$					$T_j=25^\circ\text{C}$ $T_j=125^\circ\text{C}$	214 228			
Fall time	$t_f$					$T_j=25^\circ\text{C}$ $T_j=125^\circ\text{C}$	4,9 5,2			
Turn-on energy loss per pulse	$E_{on}$					$T_j=25^\circ\text{C}$ $T_j=125^\circ\text{C}$	0,52 1,26			
Turn-off energy loss per pulse	$E_{off}$	$T_j=25^\circ\text{C}$ $T_j=125^\circ\text{C}$	0,34 0,63		mWs					
Total gate charge	$Q_g$						119			nC
Gate to source charge	$Q_{gs}$	0/10	480	18	$T_j=25^\circ\text{C}$		14			
Gate to drain charge	$Q_{gd}$						61			
Input capacitance	$C_{iss}$	f=1MHz	0	100		$T_j=25^\circ\text{C}$	2660			pF
Output capacitance	$C_{oss}$						154			
Effective output capacitance, energy related	$C_{\alpha(er)}$		0	480		$T_j=25^\circ\text{C}$	100			
Thermal resistance chip to heatsink per chip	$R_{thJH}$	Thermal grease thickness $\leq$ 50 $\mu$ m					1,05			K/W
Thermal resistance chip to case per chip	$R_{thJC}$	$\lambda = 1$ W/mK					0,69			

\*\* see gate drive conditions at characteristic figures

**Thermistor**

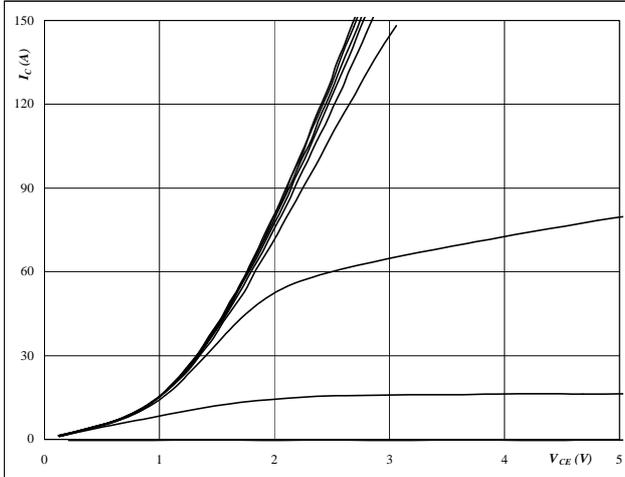
Rated resistance	R					$T=25^\circ\text{C}$	22000		$\Omega$
Deviation of R25	$\Delta R/R$	R100=1486 $\Omega$				$T=100^\circ\text{C}$	-5	+5	%
Power dissipation	P					$T=25^\circ\text{C}$	200		mW
Power dissipation constant						$T_j=25^\circ\text{C}$	2		mW/K
B-value	$B_{(25/50)}$	Tol. $\pm$ 3%				$T_j=25^\circ\text{C}$	3950		K
B-value	$B_{(25/100)}$	Tol. $\pm$ 3%				$T_j=25^\circ\text{C}$	3996		K
Vincotech NTC Reference								B	

## Input Boost

**Figure 1** IGBT+MOSFET

**Typical output characteristics**

$I_C = f(V_{CE})$

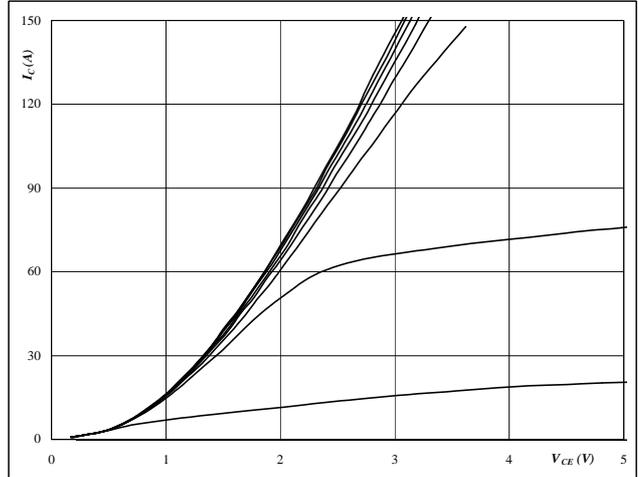


**At**  
 $t_p = 250 \mu s$   
 $T_J = 25 \text{ } ^\circ C$   
 $V_{GE}$  from 3 V to 19 V in steps of 2 V

**Figure 2** IGBT+MOSFET

**Typical output characteristics**

$I_C = f(V_{CE})$

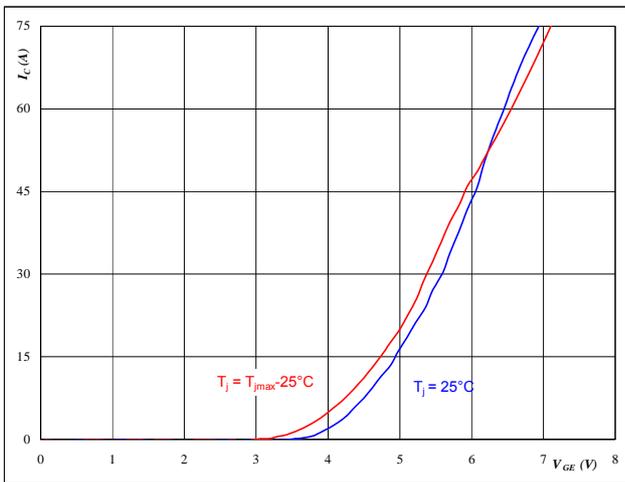


**At**  
 $t_p = 250 \mu s$   
 $T_J = 126 \text{ } ^\circ C$   
 $V_{GE}$  from 3 V to 19 V in steps of 2 V

**Figure 3** IGBT+MOSFET

**Typical transfer characteristics**

$I_C = f(V_{GE})$

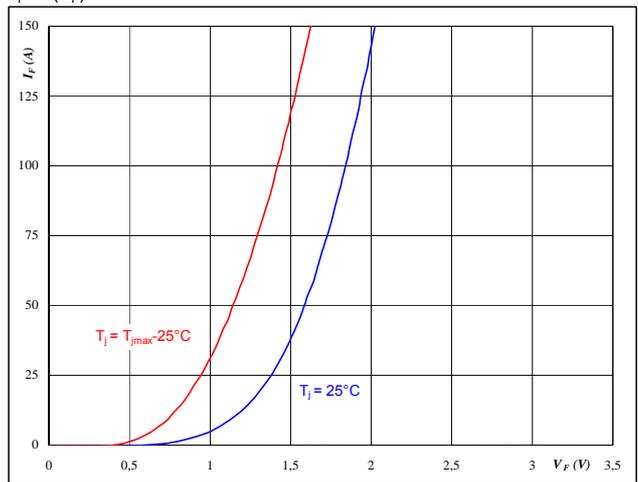


**At**  
 $t_p = 250 \mu s$   
 $V_{CE} = 10 V$

**Figure 4** FWD

**Typical diode forward current as a function of forward voltage**

$I_F = f(V_F)$

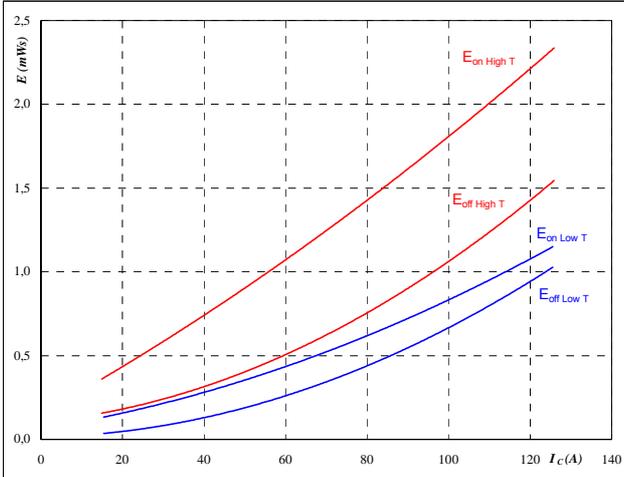


**At**  
 $t_p = 250 \mu s$

## Input Boost

**Figure 5** IGBT+MOSFET

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



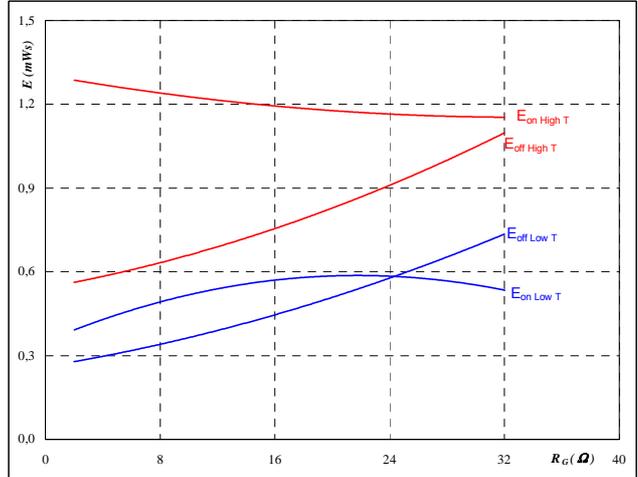
With an inductive load at

$T_J = 25/126 \text{ } ^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = 15 \text{ V}$   
 $R_{gon} = 8 \text{ } \Omega$   
 $R_{goff} = 8 \text{ } \Omega$

MOSFET turn off delayed by 100ns

**Figure 6** IGBT+MOSFET

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



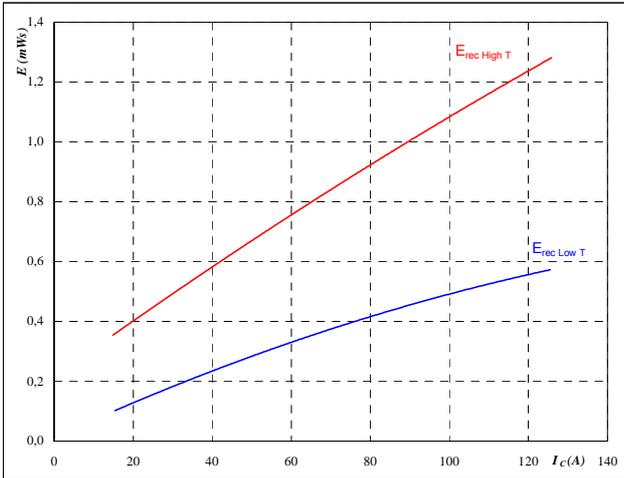
With an inductive load at

$T_J = 25/126 \text{ } ^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = 15 \text{ V}$   
 $I_C = 70 \text{ A}$

MOSFET turn off delayed by 100ns

**Figure 7** FWD

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



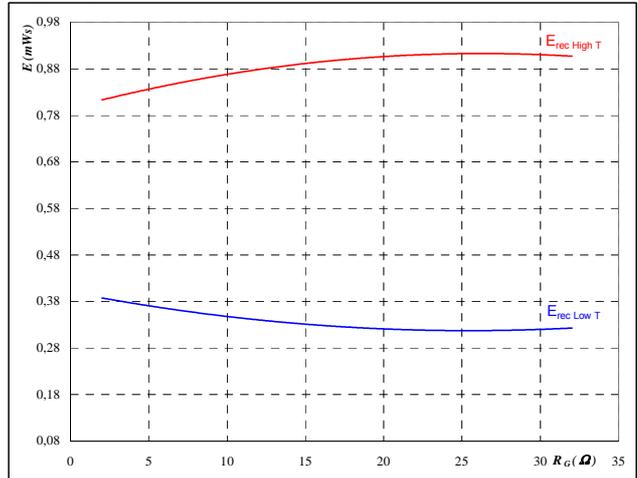
With an inductive load at

$T_J = 25/126 \text{ } ^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = 15 \text{ V}$   
 $R_{gon} = 8 \text{ } \Omega$

MOSFET turn off delayed by 100ns

**Figure 8** FWD

**Typical reverse recovery energy loss**  
 as a function of gate resistor  
 $E_{rec} = f(R_G)$



With an inductive load at

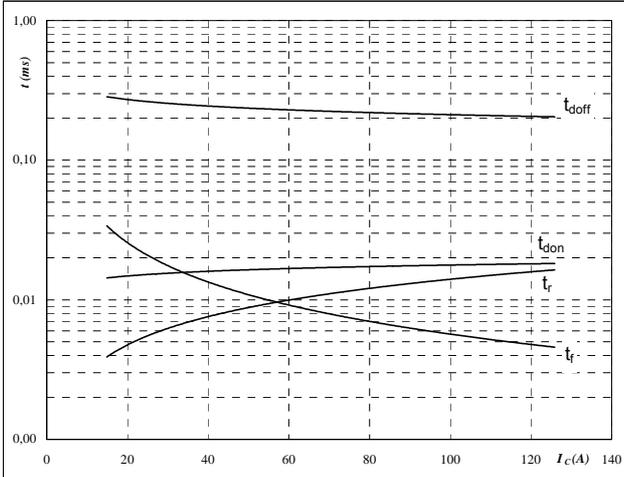
$T_J = 25/126 \text{ } ^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = 15 \text{ V}$   
 $I_C = 70 \text{ A}$

MOSFET turn off delayed by 100ns

## Input Boost

**Figure 9** IGBT+MOSFET

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



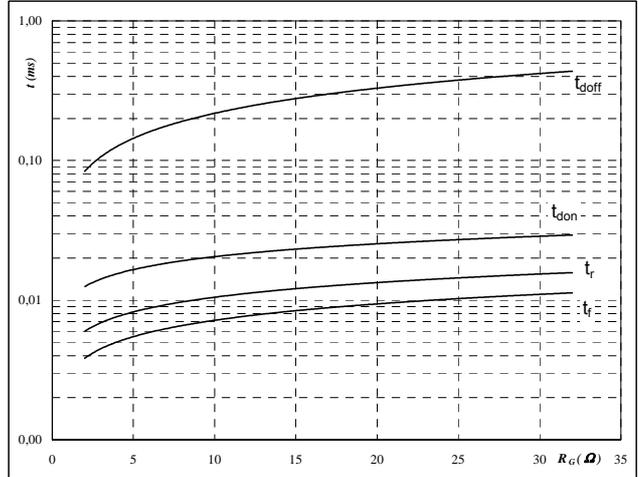
With an inductive load at

$T_j = 126 \text{ } ^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = 15 \text{ V}$   
 $R_{gon} = 8 \text{ } \Omega$   
 $R_{goff} = 8 \text{ } \Omega$

MOSFET turn off delayed by 100ns

**Figure 10** IGBT+MOSFET

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



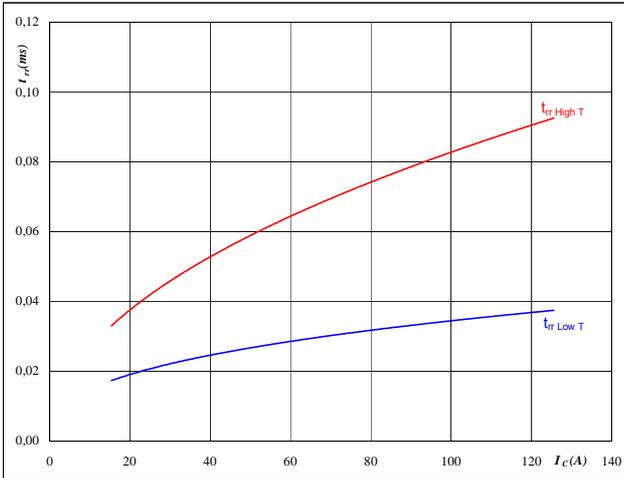
With an inductive load at

$T_j = 126 \text{ } ^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = 15 \text{ V}$   
 $I_C = 70 \text{ A}$

MOSFET turn off delayed by 100ns

**Figure 11** FWD

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

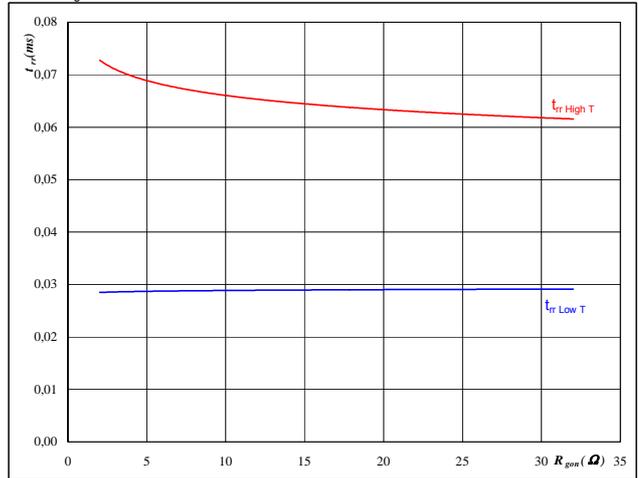


At

$T_j = 25/126 \text{ } ^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = 15 \text{ V}$   
 $R_{gon} = 8 \text{ } \Omega$

**Figure 12** FWD

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



At

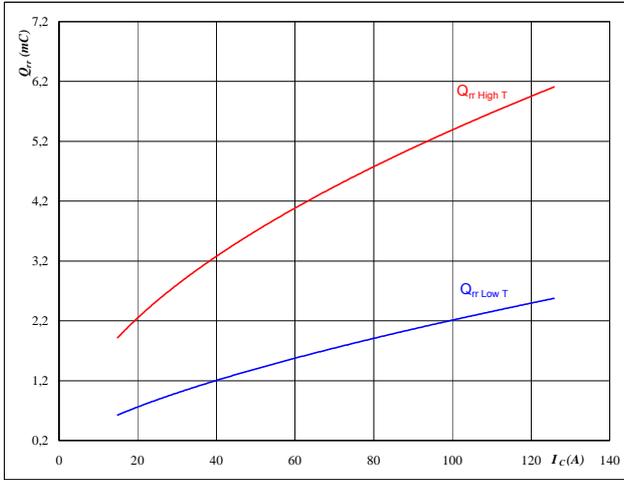
$T_j = 25/126 \text{ } ^\circ\text{C}$   
 $V_R = 350 \text{ V}$   
 $I_F = 70 \text{ A}$   
 $V_{GE} = 15 \text{ V}$

## Input Boost

**Figure 13** FWD

**Typical reverse recovery charge as a function of collector current**

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

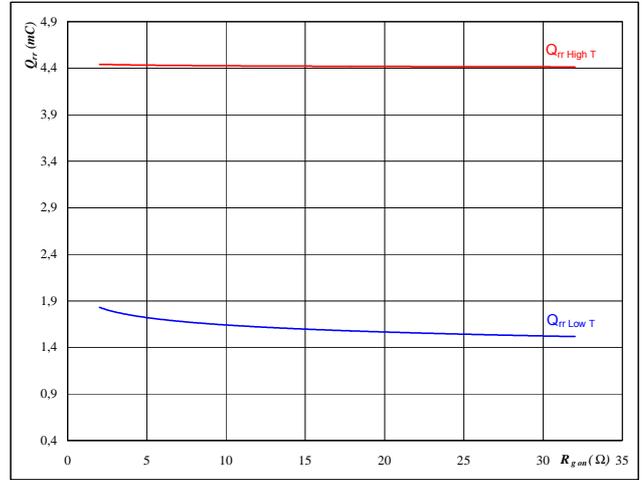


**At**  
 $T_J = 25/126$  °C  
 $V_{CE} = 350$  V  
 $V_{GE} = 15$  V  
 $R_{gon} = 8$  Ω

**Figure 14** FWD

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

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

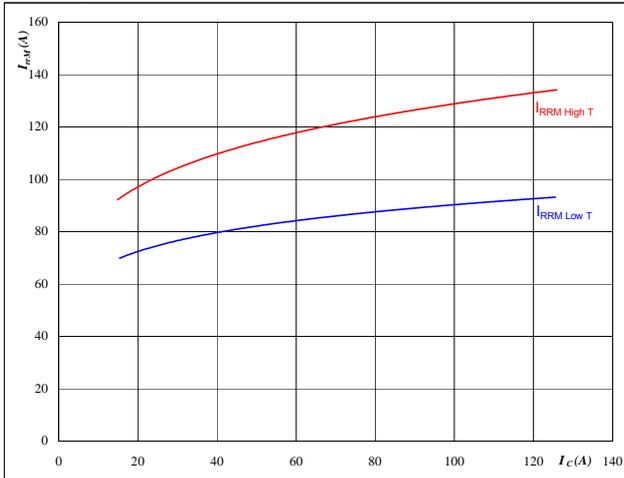


**At**  
 $T_J = 25/126$  °C  
 $V_R = 350$  V  
 $I_F = 70$  A  
 $V_{GE} = 15$  V

**Figure 15** FWD

**Typical reverse recovery current as a function of collector current**

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

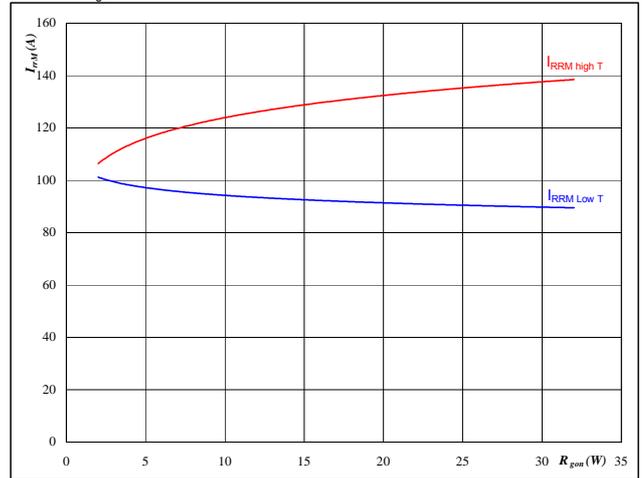


**At**  
 $T_J = 25/126$  °C  
 $V_{CE} = 350$  V  
 $V_{GE} = 15$  V  
 $R_{gon} = 8$  Ω

**Figure 16** FWD

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

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

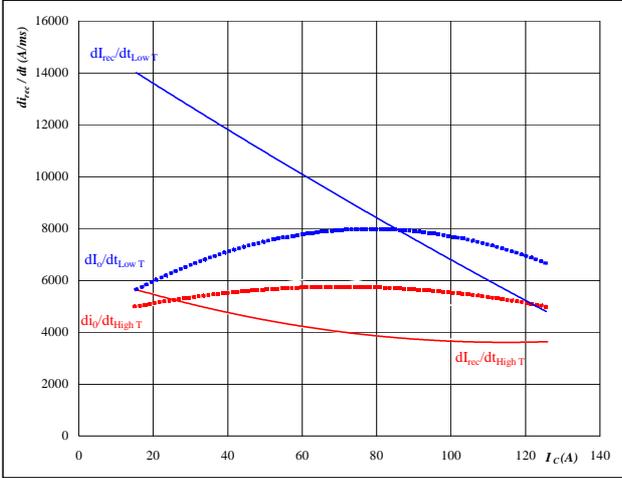


**At**  
 $T_J = 25/126$  °C  
 $V_R = 350$  V  
 $I_F = 70$  A  
 $V_{GE} = 15$  V

## Input Boost

Figure 17 FWD

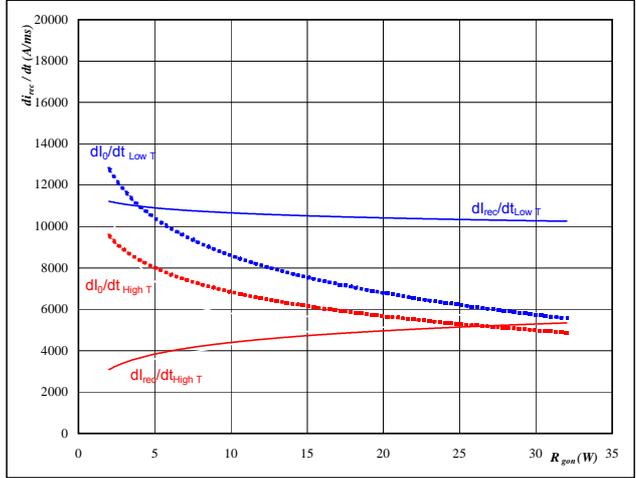
Typical rate of fall of forward and reverse recovery current as a function of collector current  
 $di_o/dt, di_{rec}/dt = f(I_c)$



At  
 $T_j = 25/126 \text{ } ^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = 15 \text{ V}$   
 $R_{gon} = 8 \text{ } \Omega$

Figure 18 FWD

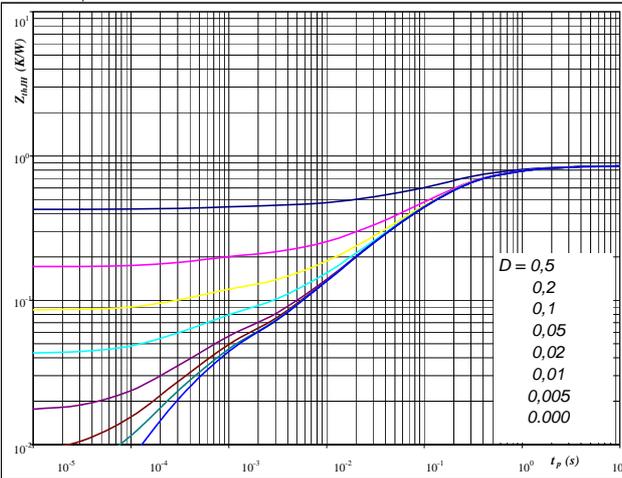
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor  
 $di_o/dt, di_{rec}/dt = f(R_{gon})$



At  
 $T_j = 25/126 \text{ } ^\circ\text{C}$   
 $V_R = 350 \text{ V}$   
 $I_F = 70 \text{ A}$   
 $V_{GE} = 15 \text{ V}$

Figure 19 IGBT

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



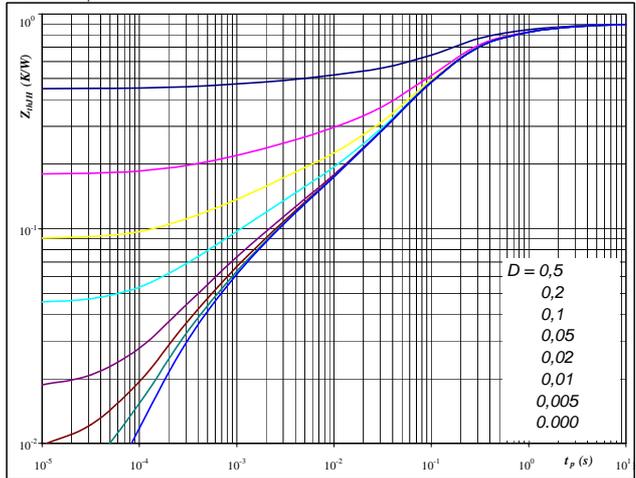
At  
 $D = t_p / T$   
 $R_{thJH} = 0,85 \text{ K/W}$

IGBT thermal model values

R (C/W)	Tau (s)
0,10	1,8E+00
0,32	2,8E-01
0,30	8,4E-02
0,09	1,2E-02
0,04	5,0E-04

Figure 20 FWD

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



At  
 $D = t_p / T$   
 $R_{thJH} = 0,90 \text{ K/W}$

FRED thermal model values

R (C/W)	Tau (s)
0,04	5,0E+00
0,17	7,0E-01
0,47	1,4E-01
0,11	2,5E-02
0,07	2,6E-03
0,03	3,4E-04

## Input Boost

**Figure 21** IGBT

**Power dissipation as a function of heatsink temperature**

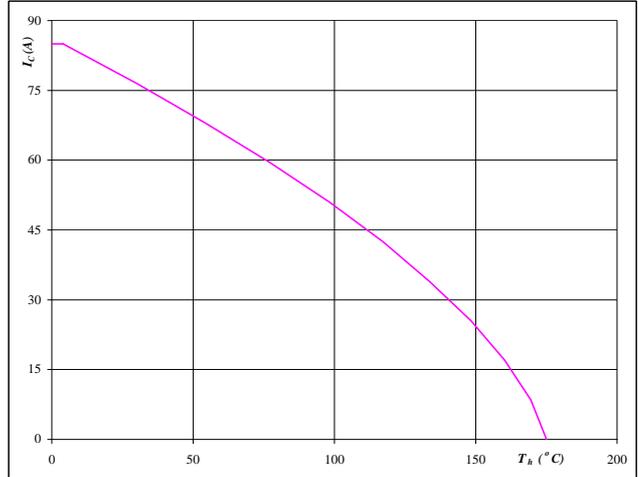
$$P_{tot} = f(T_h)$$


**At**  
 $T_j = 175$  °C

**Figure 22** IGBT

**Collector current as a function of heatsink temperature**

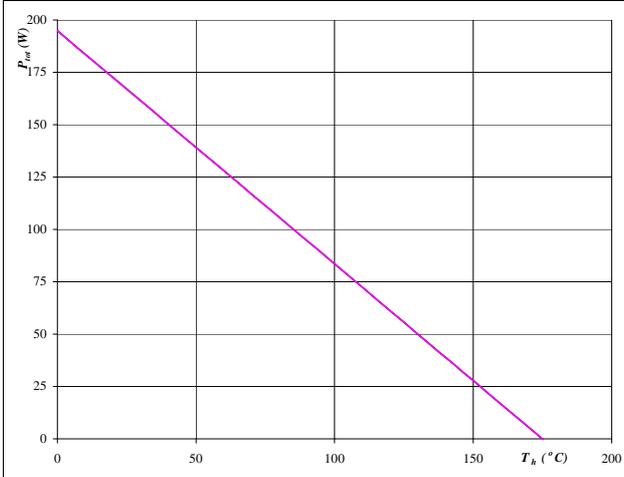
$$I_C = f(T_h)$$


**At**  
 $T_j = 175$  °C  
 $V_{GE} = 15$  V

**Figure 23** FWD

**Power dissipation as a function of heatsink temperature**

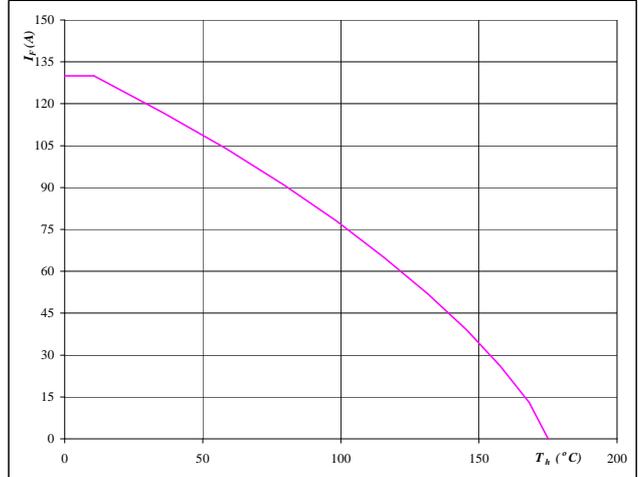
$$P_{tot} = f(T_h)$$


**At**  
 $T_j = 175$  °C

**Figure 24** FWD

**Forward current as a function of heatsink temperature**

$$I_F = f(T_h)$$

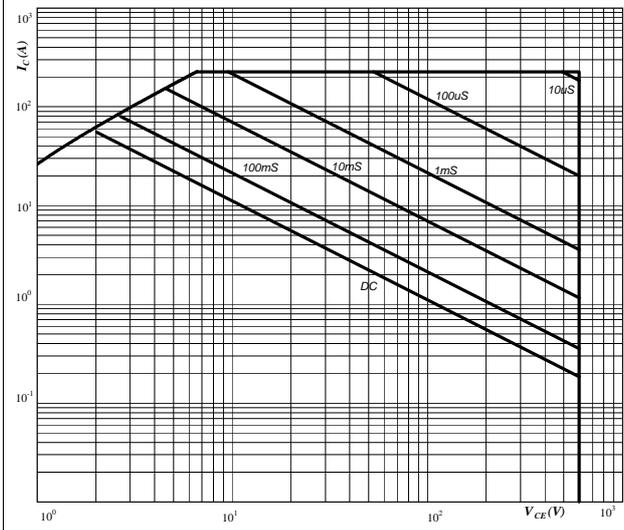

**At**  
 $T_j = 175$  °C

## Input Boost

**Figure 25** IGBT

**Safe operating area as a function of collector-emitter voltage**

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

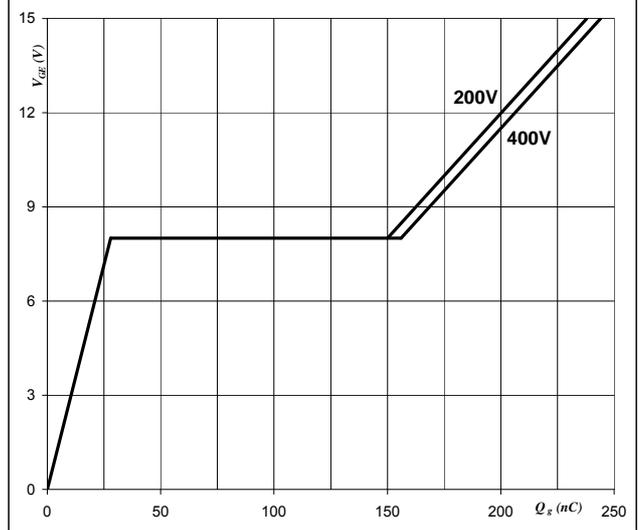


At  
 D = single pulse  
 Th = 80 °C  
 V<sub>GE</sub> = 15 V  
 T<sub>j</sub> = T<sub>jmax</sub> °C

**Figure 26** IGBT

**Gate voltage vs Gate charge**

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

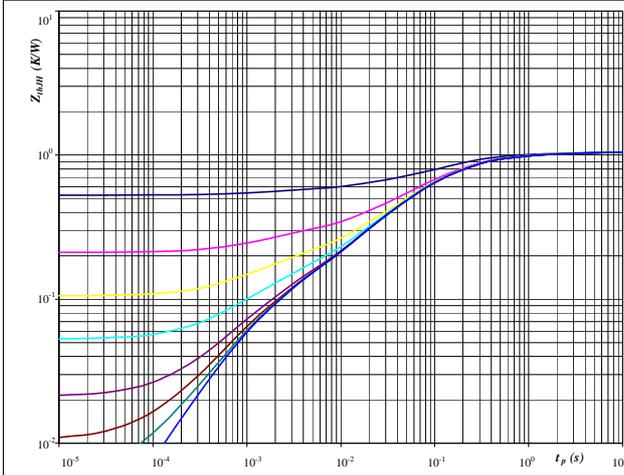


At  
 I<sub>C</sub> = 75 A

**Figure 27** MOSFET

**MOSFET transient thermal impedance as a function of pulse width**

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



At  
 D = t<sub>p</sub> / T  
 R<sub>thJH</sub> = 1,05 K/W

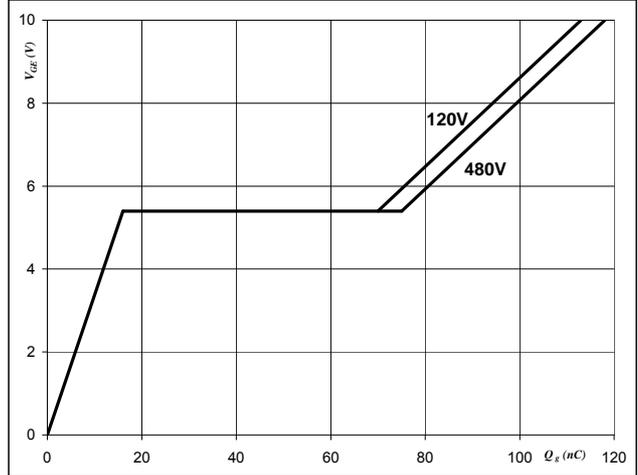
MOSFET thermal model values

R (C/W)	Tau (s)
0,06	3,4E+00
0,23	4,0E-01
0,53	8,8E-02
0,15	1,5E-02
0,08	1,3E-03
0,05	4,7E-04

**Figure 28** MOSFET

**Gate voltage vs Gate charge**

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

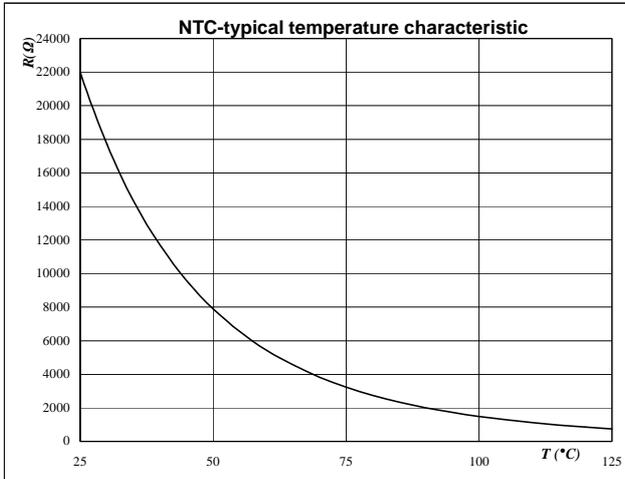


At  
 I<sub>C</sub> = 18 A

## Thermistor

**Figure 1** Thermistor

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

 $R_T = f(T)$ 

**Figure 2** Thermistor

**Typical NTC resistance values**

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

## Switching Definitions INPUT BOOST MOSFET+IGBT

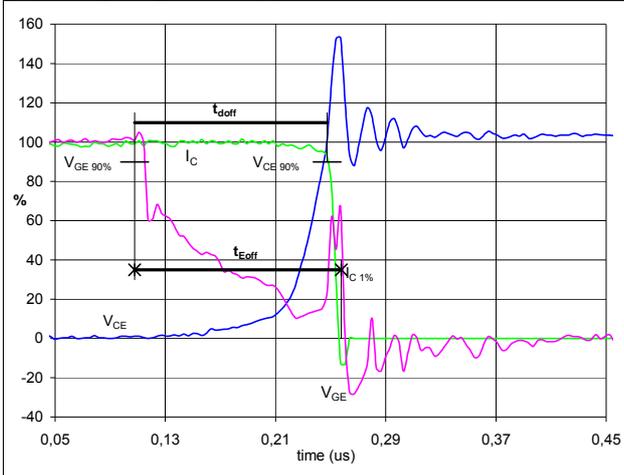
### General conditions

$T_j$	=	125 °C
$R_{gon\ IGBT}$	=	8 $\Omega$
$R_{goff\ IGBT}$	=	8 $\Omega$

MOSFET turn off delayed by 100ns

**Figure 1** INPUT BOOST MOSFET+IGBT

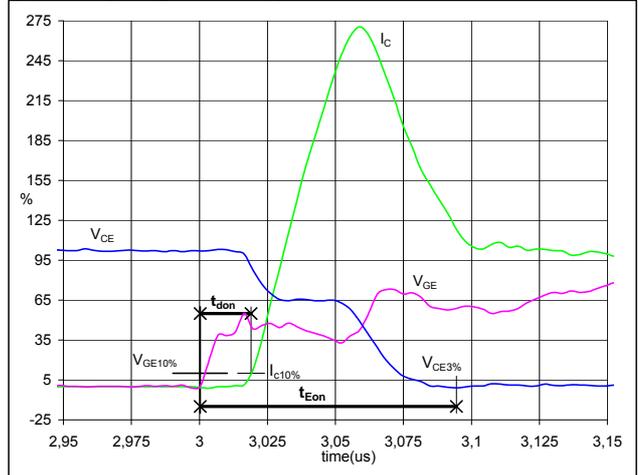
**Turn-off Switching Waveforms & definition of  $t_{doff}$ ,  $t_{Eoff}$**   
 ( $t_{Eoff}$  = integrating time for  $E_{off}$ )



$V_{GE} (0\%) =$	0	V
$V_{GE} (100\%) =$	15	V
$V_C (100\%) =$	350	V
$I_C (100\%) =$	70	A
$t_{doff} =$	0,23	$\mu s$
$t_{Eoff} =$	0,15	$\mu s$

**Figure 2** INPUT BOOST MOSFET+IGBT

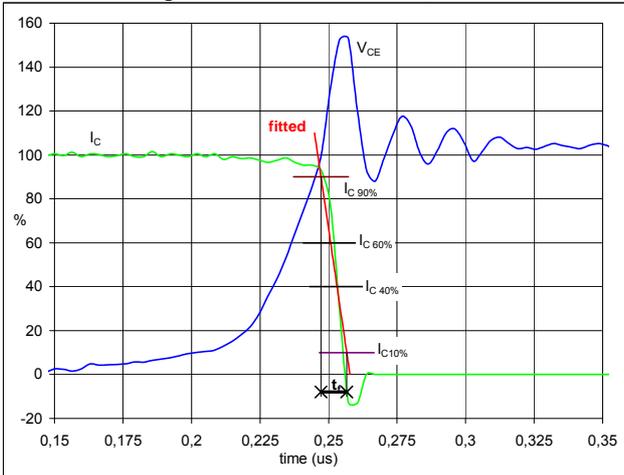
**Turn-on Switching Waveforms & definition of  $t_{don}$ ,  $t_{Eon}$**   
 ( $t_{Eon}$  = integrating time for  $E_{on}$ )



$V_{GE} (0\%) =$	0	V
$V_{GE} (100\%) =$	15	V
$V_C (100\%) =$	350	V
$I_C (100\%) =$	70	A
$t_{don} =$	0,02	$\mu s$
$t_{Eon} =$	0,09	$\mu s$

**Figure 3** INPUT BOOST MOSFET+IGBT

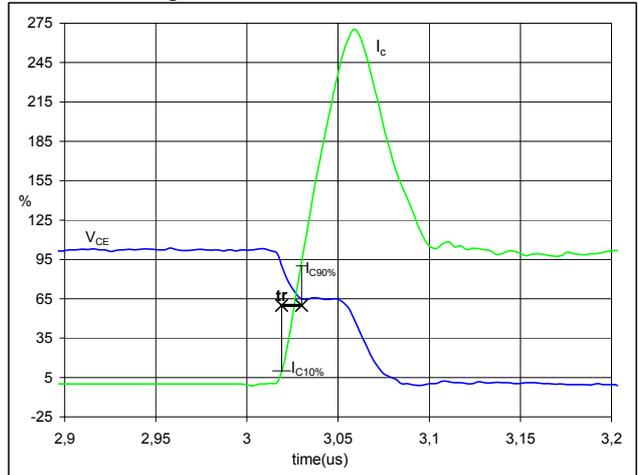
**Turn-off Switching Waveforms & definition of  $t_f$**



$V_C (100\%) =$	350	V
$I_C (100\%) =$	70	A
$t_f =$	0,005	$\mu s$

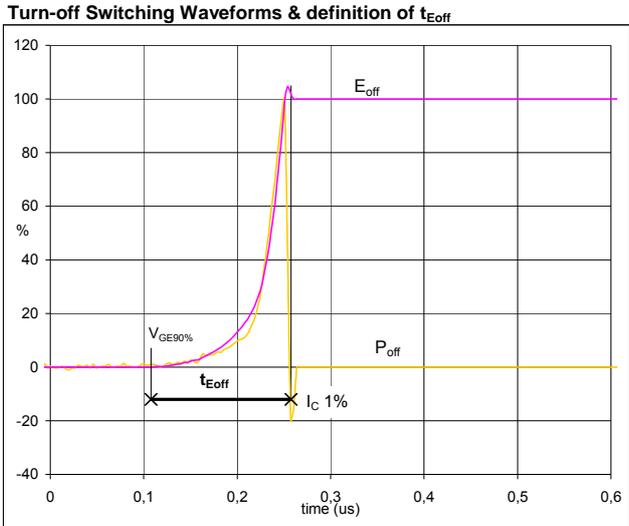
**Figure 4** INPUT BOOST MOSFET+IGBT

**Turn-on Switching Waveforms & definition of  $t_f$**

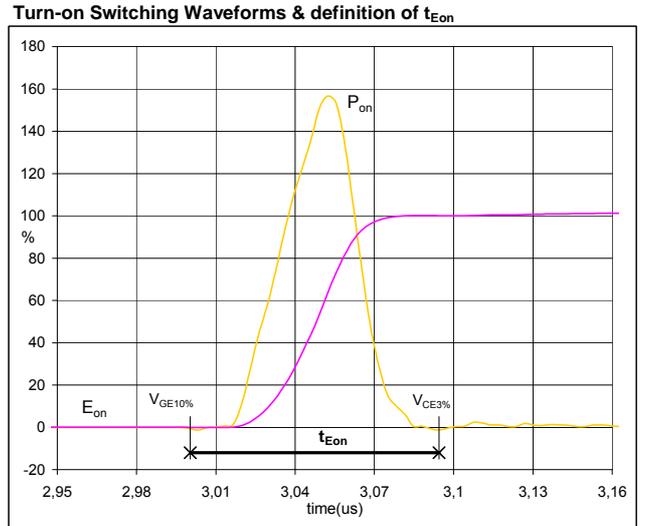


$V_C (100\%) =$	350	V
$I_C (100\%) =$	70	A
$t_f =$	0,010	$\mu s$

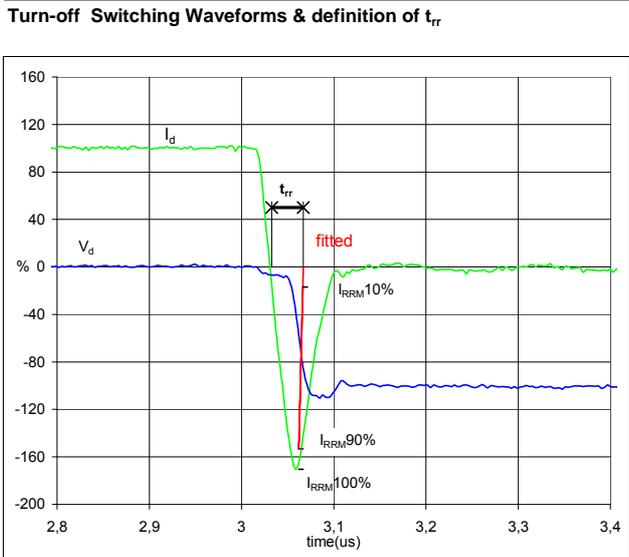
## Switching Definitions INPUT BOOST MOSFET+IGBT

**Figure 5** INPUT BOOST MOSFET+IGBT


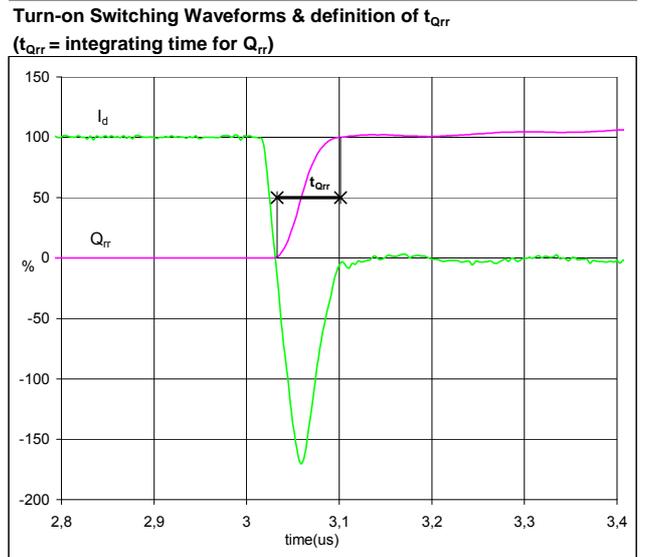
$P_{off}(100\%) =$	24,65	kW
$E_{off}(100\%) =$	0,63	mJ
$t_{Eoff} =$	0,15	$\mu s$

**Figure 6** INPUT BOOST MOSFET+IGBT


$P_{on}(100\%) =$	24,65	kW
$E_{on}(100\%) =$	1,26	mJ
$t_{Eon} =$	0,09	$\mu s$

**Figure 7** INPUT BOOST MOSFET+IGBT


$V_d(100\%) =$	350	V
$I_d(100\%) =$	70	A
$I_{RRM}(100\%) =$	-121	A
$t_{rr} =$	0,068	$\mu s$

**Figure 8** INPUT BOOST MOSFET+IGBT


$I_d(100\%) =$	70	A
$Q_{rr}(100\%) =$	4,38	$\mu C$
$t_{Qrr} =$	0,07	$\mu s$



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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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