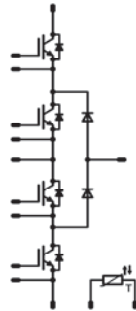


flowNPC0		600V/30A	
Features • Neutral-point-Clamped inverter • Clip-In PCB mounting • Low Inductance Layout		flow0 housing 	
Target Applications • UPS and Solar		Schematic 	
Types • 10-FZ06NIA030SA-P924F33			

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
-----------	--------	-----------	-------	------

Buck 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	30 40	A
Pulsed collector current	I _{Cpulse}	t _p limited by T _{jmax}	90	A
Power dissipation per IGBT	P _{tot}	T _j =T _{jmax} T _h =80°C T _c =80°C	56 85	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
Turn off safe operating area		T _j ≤150°C V _{CE} ≤V _{CES}	60	A

Buck 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 T _c =80°C	27 36	A
Repetitive peak forward current	I _{FRM}	t _p limited by T _{jmax} T _c =100°C	90	A
Power dissipation per Diode	P _{tot}	T _j =T _{jmax} T _h =80°C T _c =80°C	44 67	W
Maximum Junction Temperature	T _{jmax}		175	°C

Maximum Ratings

 $T_j = 25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Boost IGBT				
Collector-emitter break down voltage	V_{CES}		600	V
DC collector current	I_C	$T_j = T_{jmax}$ $T_h = 80^\circ\text{C}$ $T_c = 80^\circ\text{C}$	30 39	A
Pulsed collector current	I_{Cpuls}	t_p limited by T_{jmax}	90	A
Power dissipation per IGBT	P_{tot}	$T_j = T_{jmax}$ $T_h = 80^\circ\text{C}$ $T_c = 80^\circ\text{C}$	56 85	W
Gate-emitter peak voltage	V_{GE}		± 20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j \leq 150^\circ\text{C}$ $V_{GE} = 15\text{V}$	6 360	μs V
Maximum Junction Temperature	T_{jmax}		175	$^\circ\text{C}$
Turn off safe operating area		$T_j \leq 150^\circ\text{C}$ $V_{CE} \leq V_{CES}$	60	A

Buck and Boost Inverse FWD

Peak Repetitive Reverse Voltage	V_{RRM}	$T_c = 25^\circ\text{C}$	600	V
DC forward current	I_F	$T_j = T_{jmax}$ $T_h = 80^\circ\text{C}$ $T_c = 80^\circ\text{C}$	26 36	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	90	A
Power dissipation per Diode	P_{tot}	$T_j = T_{jmax}$ $T_h = 80^\circ\text{C}$ $T_c = 80^\circ\text{C}$	44 67	W
Maximum Junction Temperature	T_{jmax}		175	$^\circ\text{C}$

Thermal Properties

Storage temperature	T_{stg}		$-40 \dots +125$	$^\circ\text{C}$
Operation temperature under switching condition	T_{op}		$-40 \dots (T_{jmax} - 25)$	$^\circ\text{C}$

Insulation Properties

Insulation voltage	V_{is}	$t = 2\text{s}$ 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	
Buck IGBT										
Gate emitter threshold voltage	V _{GE(th)}	V _{CE} =V _{GE}			0,00043	T _j =25°C T _j =125°C	5	5,8	6,5	V
Collector-emitter saturation voltage	V _{CE(sat)}		15		30	T _j =25°C T _j =125°C	1	1,54 1,73	1,95	V
Collector-emitter cut-off current incl. Diode	I _{CES}		0	600		T _j =25°C T _j =125°C			30	µA
Gate-emitter leakage current	I _{GES}		20	0		T _j =25°C T _j =125°C			350	nA
Integrated Gate resistor	R _{gint}							none		Ω
Turn-on delay time	t _{d(on)}	Rgoff=16 Ω Rgon=16 Ω	±15	350	30	T _j =25°C T _j =125°C		98 101		ns
Rise time	t _r					T _j =25°C T _j =125°C		11 16		
Turn-off delay time	t _{d(off)}					T _j =25°C T _j =125°C		155 174		
Fall time	t _f					T _j =25°C T _j =125°C		93 107		
Turn-on energy loss per pulse	E _{on}					T _j =25°C T _j =125°C		0,47 0,62		mWs
Turn-off energy loss per pulse	E _{off}					T _j =25°C T _j =125°C		0,80 1,02		
Input capacitance	C _{ies}	f=1MHz	0	25		T _j =25°C		1630		pF
Output capacitance	C _{oss}							108		
Reverse transfer capacitance	C _{rss}							50		
Gate charge	Q _{Gate}		±15	480	30	T _j =25°C		167		nC
Thermal resistance chip to heatsink per chip	R _{thJH}	Thermal grease thickness≤50µm λ = 1 W/mK						1,69		K/W
Buck FWD										
Diode forward voltage	V _F				30	T _j =25°C T _j =125°C	1	1,75 1,73	2,05	V
Peak reverse recovery current	I _{RRM}	Rgon=16 Ω	±15	350	30	T _j =25°C T _j =125°C		36 39		A
Reverse recovery time	t _{rr}					T _j =25°C T _j =125°C		127 183		ns
Reverse recovered charge	Q _{rr}					T _j =25°C T _j =125°C		1,41 2,29		µC
Peak rate of fall of recovery current	di(rec)max /dt					T _j =25°C T _j =125°C		4073 2293		A/µs
Reverse recovered energy	E _{rec}					T _j =25°C T _j =125°C		0,33 0,55		mWs
Thermal resistance chip to heatsink per chip	R _{thJH}	Thermal grease thickness≤50µm λ = 1 W/mK						2,15		K/W

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	
Boost IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,00043	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		30	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	1	1,54 1,73	1,95	V
Collector-emitter cut-off incl diode	I_{CES}		0	600		$T_j=25^{\circ}C$ $T_j=125^{\circ}C$			30	μA
Gate-emitter leakage current	I_{GES}		20	0		$T_j=25^{\circ}C$ $T_j=125^{\circ}C$			350	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	$R_{goff}=16 \Omega$ $R_{gon}=16 \Omega$	± 15	350	30	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		102 102		ns
Rise time	t_r					$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		15 18		
Turn-off delay time	$t_{d(off)}$					$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		158 177		
Fall time	t_f					$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		88 105		
Turn-on energy loss per pulse	E_{on}					$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		0,45 0,59		mWs
Turn-off energy loss per pulse	E_{off}					$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		0,81 1,04		
Input capacitance	C_{ies}	$f=1MHz$	0	25		$T_j=25^{\circ}C$		1630		pF
Output capacitance	C_{oss}							108		
Reverse transfer capacitance	C_{rss}							50		
Gate charge	Q_{Gate}		± 15	480	30	$T_j=25^{\circ}C$		167		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness $\leq 50\mu m$ $\lambda = 1 W/mK$						1,69		K/W
Buck and Boost Inverse FWD										
Diode forward voltage	V_F				30	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	1	1,75 1,73	2,05	V
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness $\leq 50\mu m$ $\lambda = 1 W/mK$						2,15		K/W
Thermistor										
Rated resistance	R					$T=25^{\circ}C$		22000		Ω
Deviation of R100	$\Delta R/R$	$R_{100}=1486 \Omega$				$T=100^{\circ}C$	-5		5	%
Power dissipation	P					$T=25^{\circ}C$		200		mW
Power dissipation constant						$T=25^{\circ}C$		2		mW/K
B-value	$B_{(25/50)}$	Tol. $\pm 3\%$				$T=25^{\circ}C$		3950		K
B-value	$B_{(25/100)}$	Tol. $\pm 3\%$				$T=25^{\circ}C$		3996		K
Vincotech NTC Reference						$T=25^{\circ}C$			B	

Buck

Figure 1 IGBT

Typical output characteristics

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

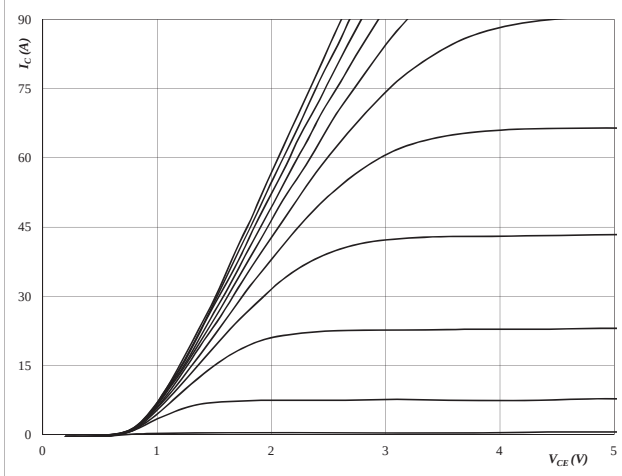

At
 $t_p = 250 \mu s$
 $T_J = 25 ^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

Figure 2 IGBT

Typical output characteristics

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

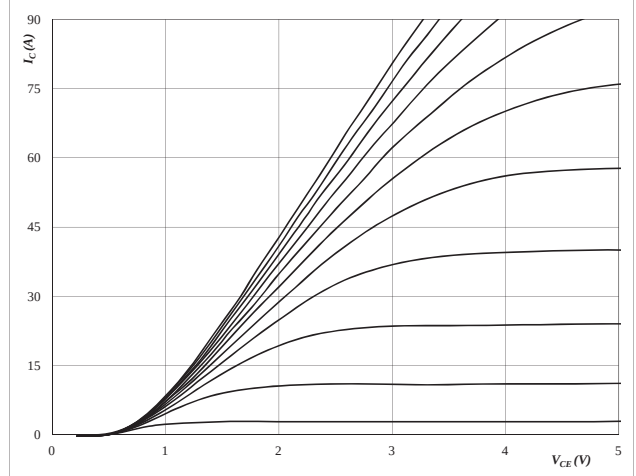
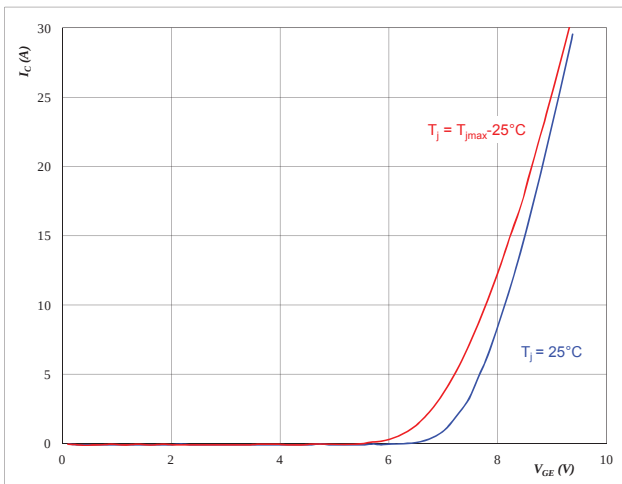

At
 $t_p = 250 \mu s$
 $T_J = 125 ^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

Figure 3 IGBT

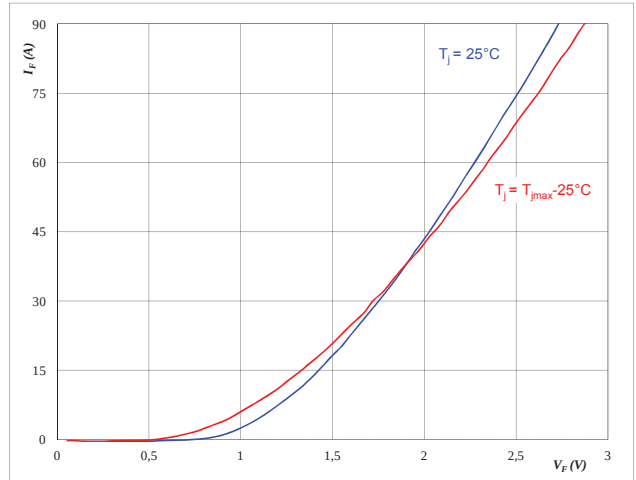
Typical transfer characteristics

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


At
 $t_p = 250 \mu s$
 $V_{CE} = 10 V$
Figure 4 FWD

Typical diode forward current as a function of forward voltage

$$I_F = f(V_F)$$

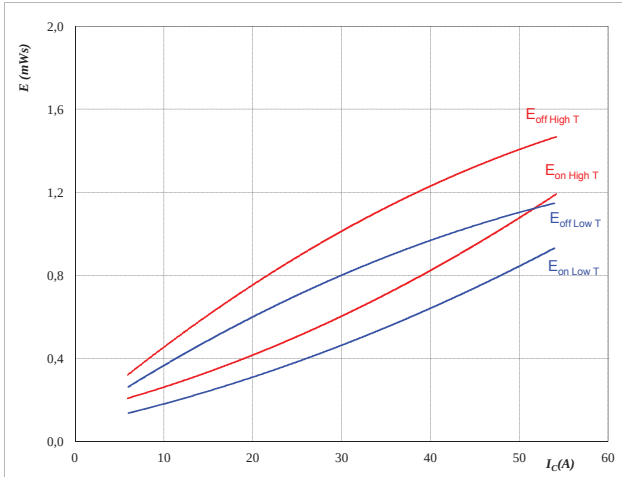

At
 $t_p = 250 \mu s$

Buck

Figure 5 IGBT

Typical switching energy losses
as a function of collector current

$$E = f(I_C)$$



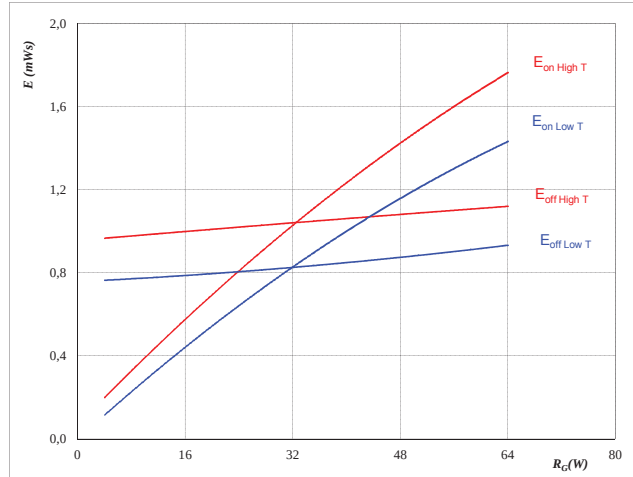
With an inductive load at

$T_J =$	25/125	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$R_{gon} =$	16	Ω
$R_{goff} =$	16	Ω

Figure 6 IGBT

Typical switching energy losses
as a function of gate resistor

$$E = f(R_G)$$



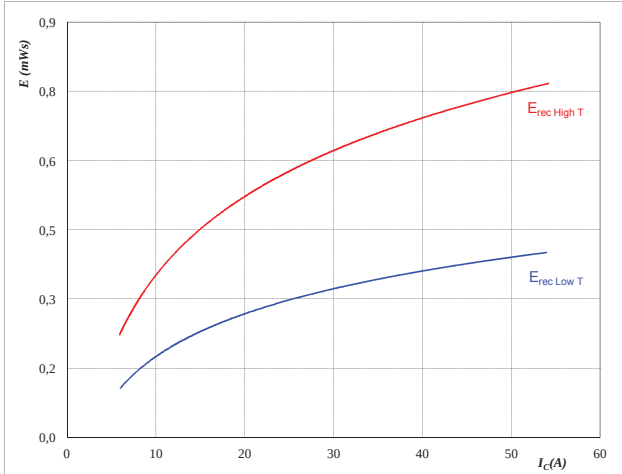
With an inductive load at

$T_J =$	25/125	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$I_C =$	31	A

Figure 7 FWD

Typical reverse recovery energy loss
as a function of collector current

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



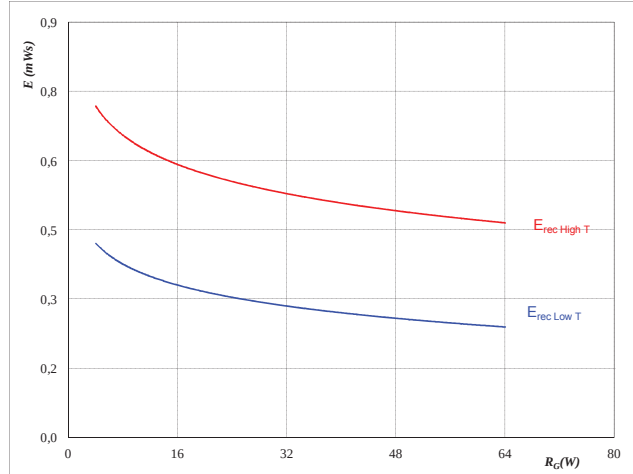
With an inductive load at

$T_J =$	25/125	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$R_{gon} =$	16	Ω

Figure 8 FWD

Typical reverse recovery energy loss
as a function of gate resistor

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



With an inductive load at

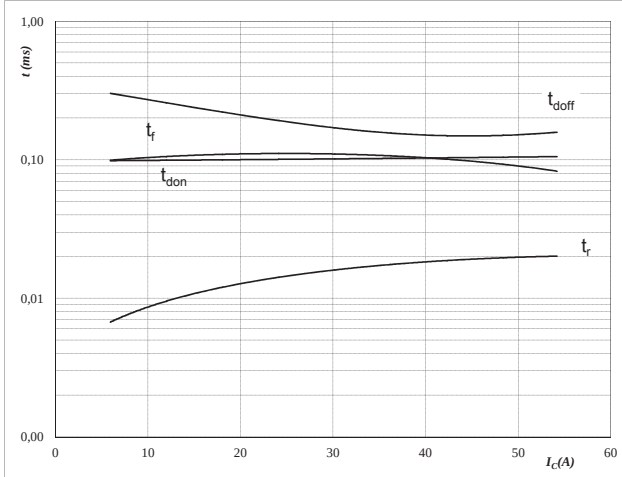
$T_J =$	25/125	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$I_C =$	31	A

Buck

Figure 9 IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



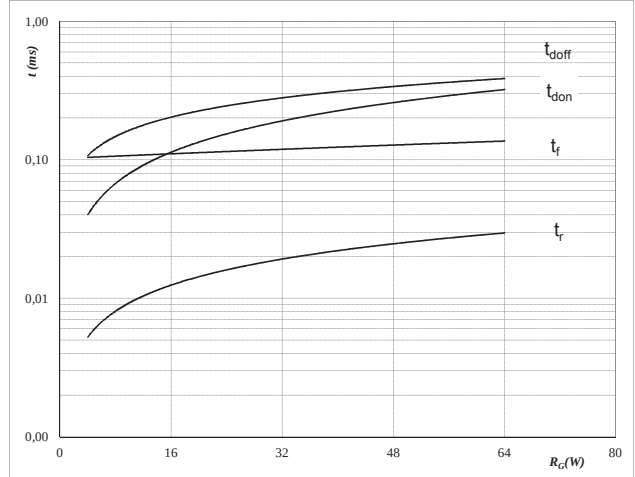
With an inductive load at

$T_J =$	125	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$R_{gon} =$	16	Ω
$R_{goff} =$	16	Ω

Figure 10 IGBT

Typical switching times as a function of gate resistor

$$t = f(R_G)$$



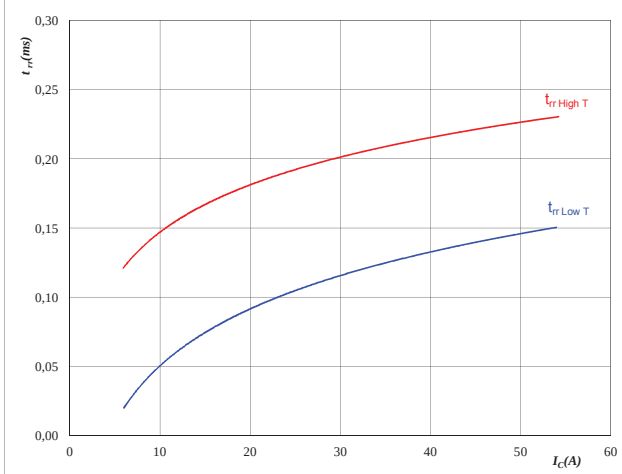
With an inductive load at

$T_J =$	125	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$I_C =$	31	A

Figure 11 FWD

Typical reverse recovery time as a function of collector current

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



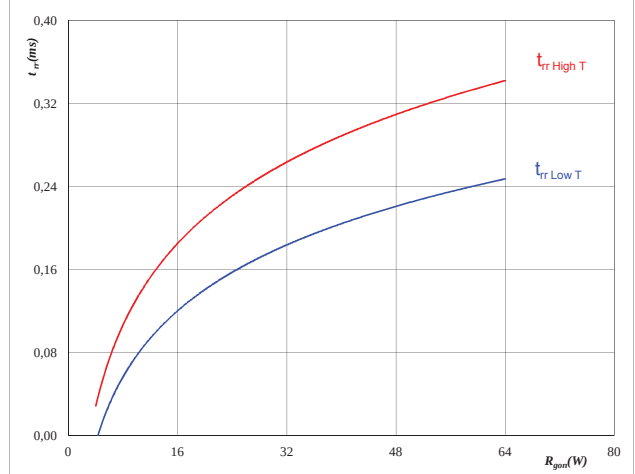
At

$T_J =$	25/125	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$R_{gon} =$	16	Ω

Figure 12 FWD

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

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



At

$T_J =$	25/125	°C
$V_R =$	350	V
$I_F =$	31	A
$V_{GE} =$	±15	V

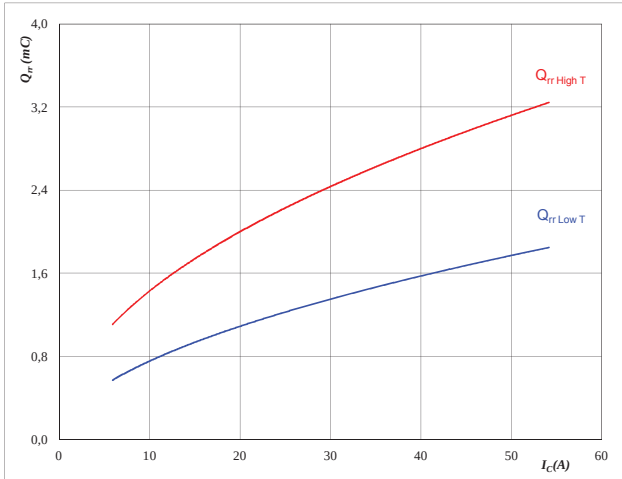
Buck

Figure 13

FWD

Typical reverse recovery charge as a function of collector current

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


At

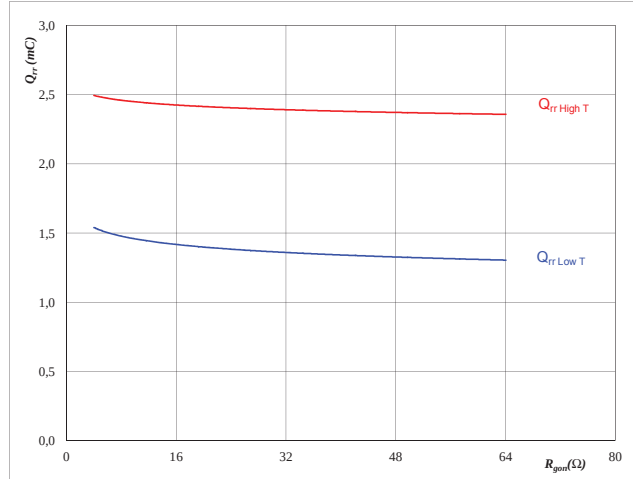
$T_J = 25/125$ °C
 $V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω

Figure 14

FWD

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

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


At

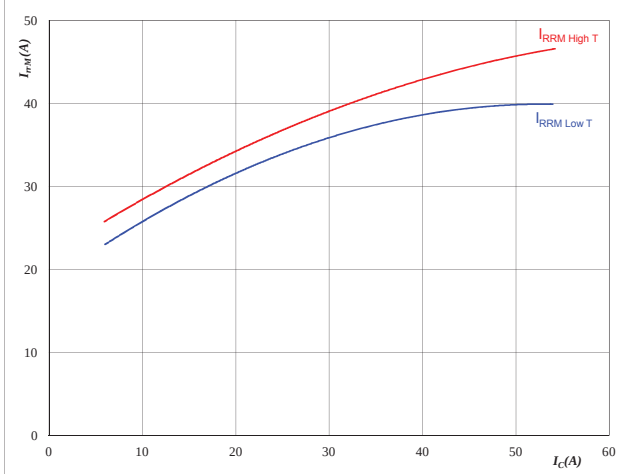
$T_J = 25/125$ °C
 $V_R = 350$ V
 $I_F = 31$ A
 $V_{GE} = \pm 15$ V

Figure 15

FWD

Typical reverse recovery current as a function of collector current

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


At

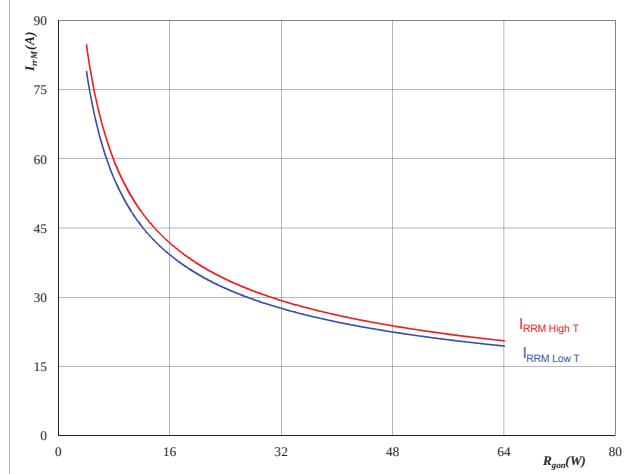
$T_J = 25/125$ °C
 $V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω

Figure 16

FWD

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

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


At

$T_J = 25/125$ °C
 $V_R = 350$ V
 $I_F = 31$ A
 $V_{GE} = \pm 15$ V
 IA

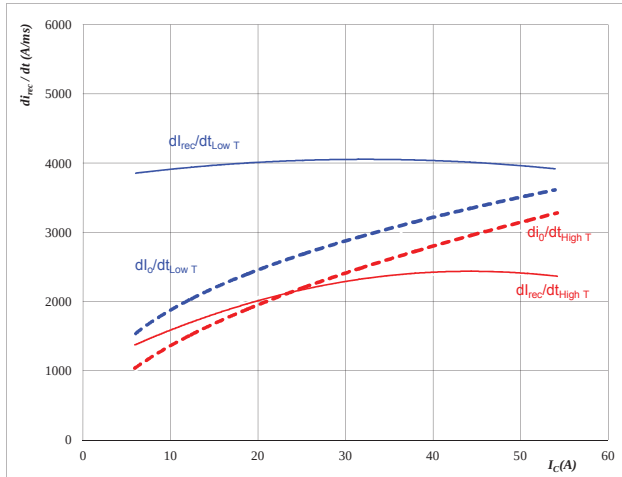
Buck

Figure 17

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

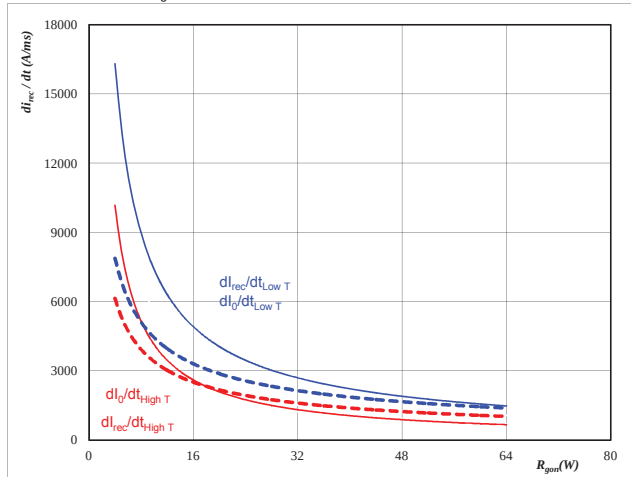
$T_J =$	25/125	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$R_{gon} =$	16	Ω

Figure 18

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

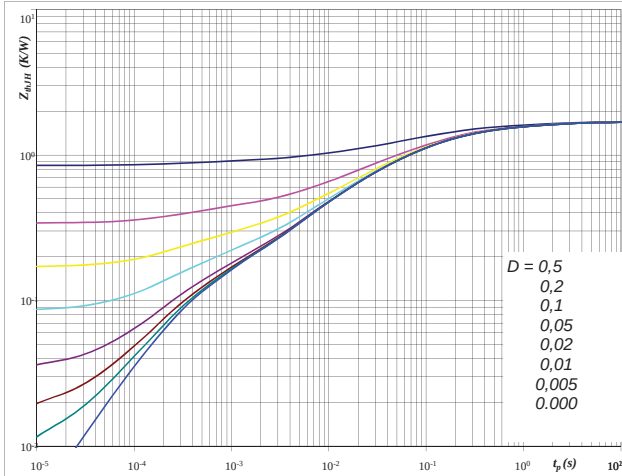
$T_J =$	25/125	°C
$V_R =$	350	V
$I_F =$	31	A
$V_{GE} =$	±15	V

Figure 19

IGBT

IGBT transient thermal impedance
as a function of pulse width

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



At

$D =$	t_p / T	
$R_{thJH} =$	1,69	K/W

IGBT thermal model values

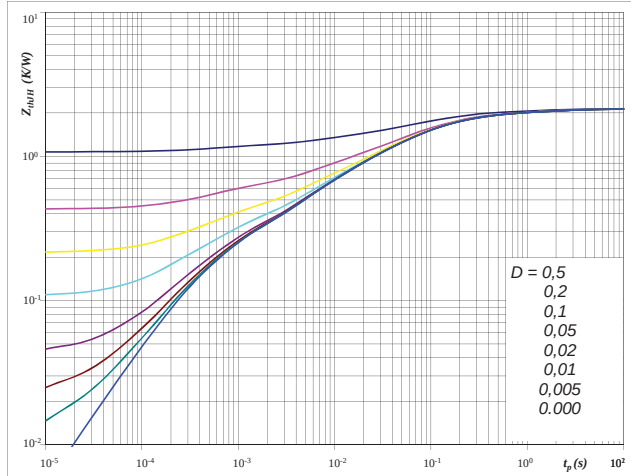
R (C/W)	Tau (s)
0,05	7,4E+00
0,23	1,0E+00
0,62	1,4E-01
0,50	2,6E-02
0,18	4,3E-03
0,11	3,2E-04

Figure 20

FWD

FWD transient thermal impedance
as a function of pulse width

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



At

$D =$	t_p / T	
$R_{thJH} =$	2,15	K/W

FWD thermal model values

R (C/W)	Tau (s)
0,05	6,8E+00
0,23	1,0E+00
0,72	1,3E-01
0,63	3,2E-02
0,32	5,4E-03
0,19	4,3E-04

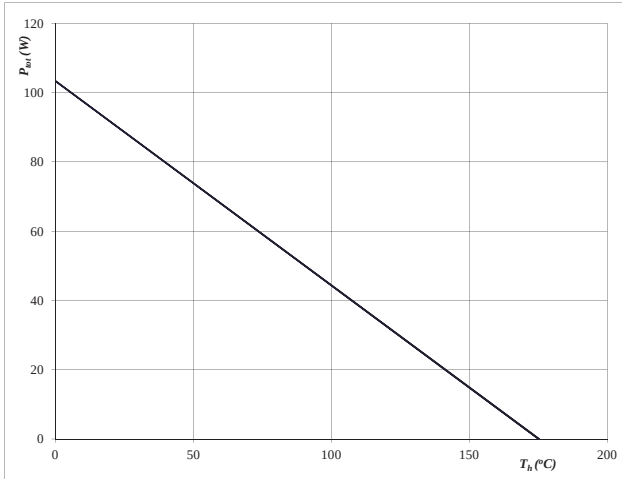
Buck

Figure 21

IGBT

Power dissipation as a function of heatsink temperature

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



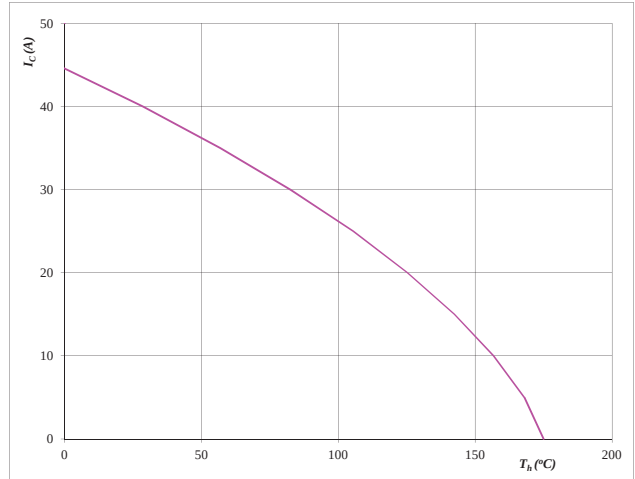
At
 $T_j = 175$ °C

Figure 22

IGBT

Collector current as a function of heatsink temperature

$$I_C = f(T_h)$$



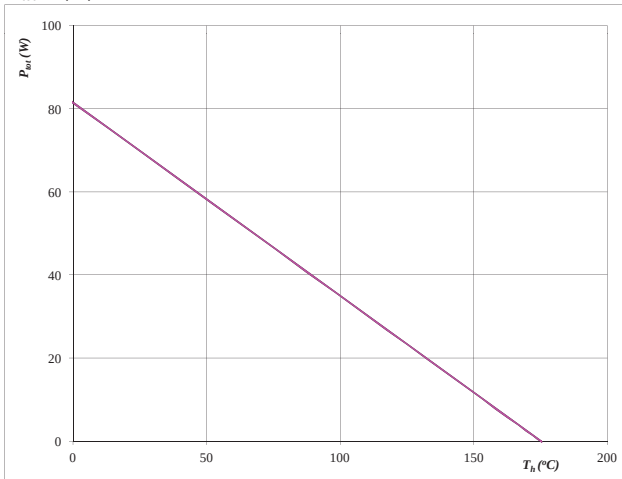
At
 $T_j = 175$ °C
 $V_{GE} = 15$ V

Figure 23

FWD

Power dissipation as a function of heatsink temperature

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



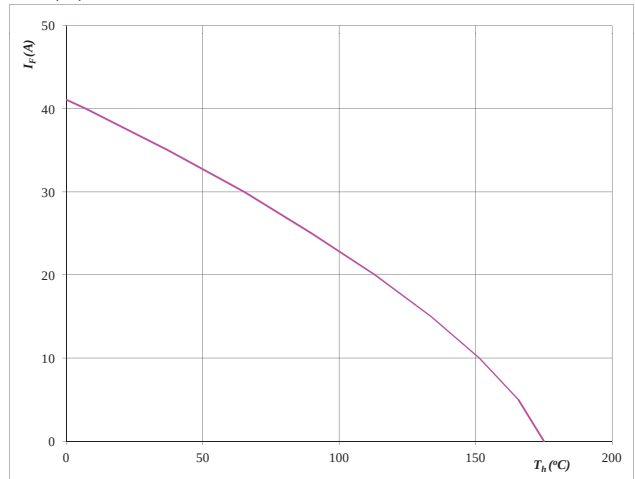
At
 $T_j = 175$ °C

Figure 24

FWD

Forward current as a function of heatsink temperature

$$I_F = f(T_h)$$



At
 $T_j = 175$ °C

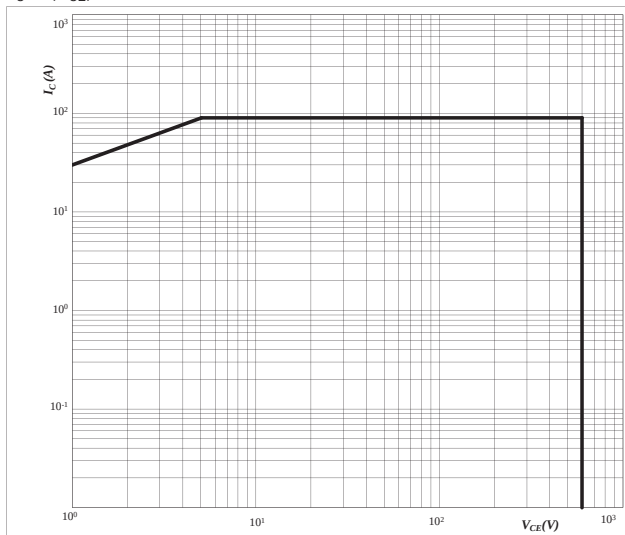
Buck & Boost

Figure 25

IGBT

Turn on safe operating area as a function
of collector-emitter voltage

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



At

$$T_J =$$

$$T_{Jmax}$$

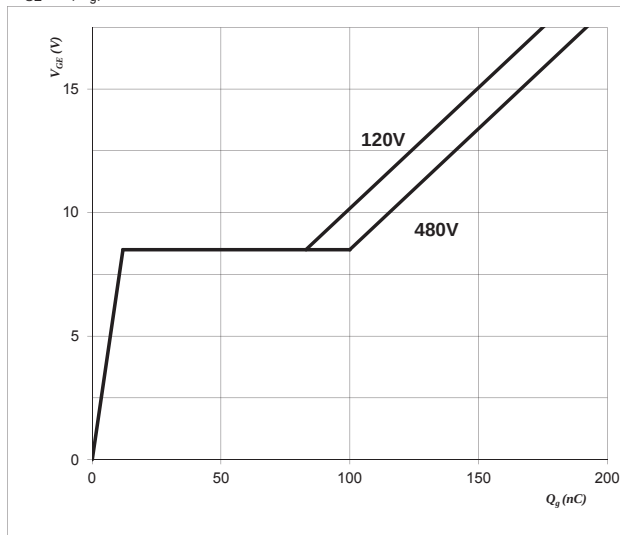
°C

Figure 26

IGBT

Gate voltage vs Gate charge

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



At

$$I_C =$$

$$31$$

A

Boost

Figure 1 IGBT

Typical output characteristics

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

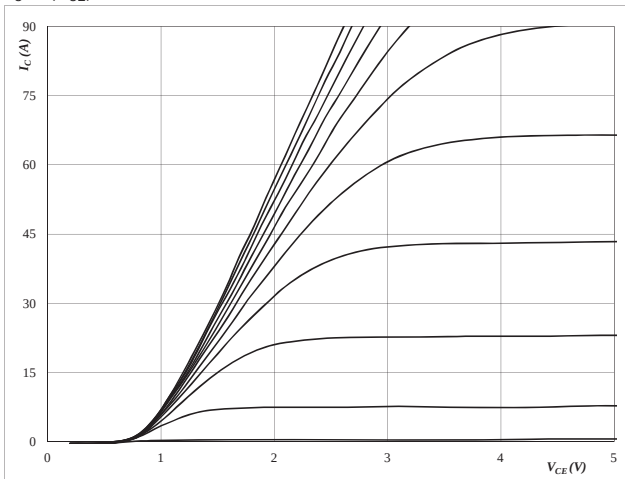

At
 $t_p = 250 \mu s$
 $T_J = 25 ^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

Figure 2 IGBT

Typical output characteristics

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

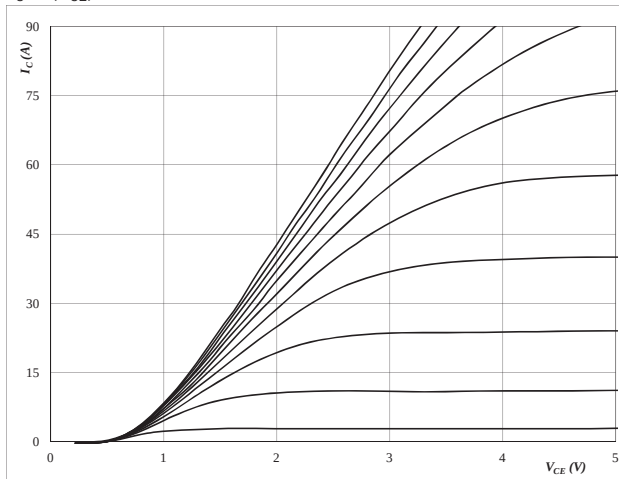
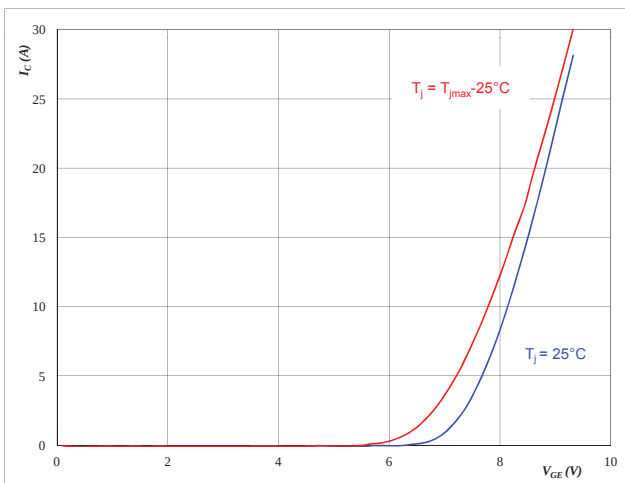

At
 $t_p = 250 \mu s$
 $T_J = 125 ^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

Figure 3 IGBT

Typical transfer characteristics

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

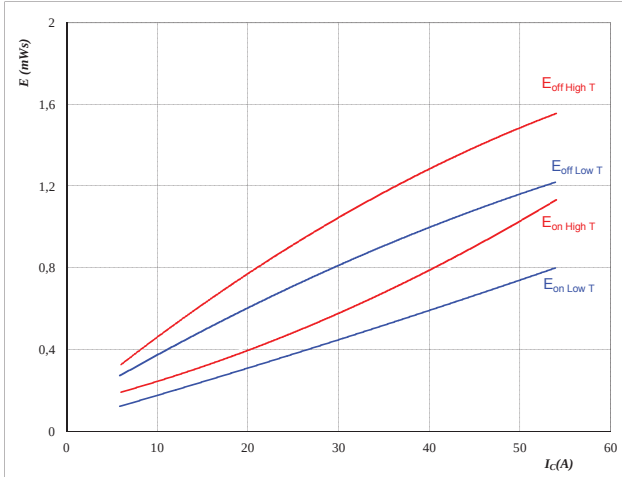

At
 $t_p = 250 \mu s$
 $V_{CE} = 10 V$

Boost

Figure 4 IGBT

Typical switching energy losses
as a function of collector current

$$E = f(I_C)$$



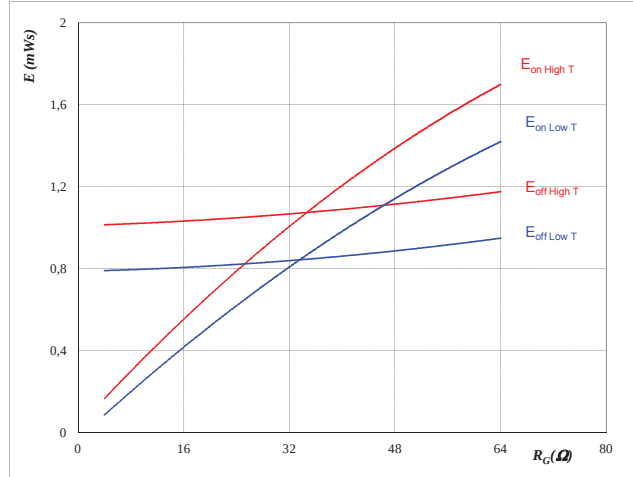
With an inductive load at

$T_J =$	25/125	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$R_{gon} =$	16	Ω
$R_{goff} =$	16	Ω

Figure 5 IGBT

Typical switching energy losses
as a function of gate resistor

$$E = f(R_G)$$



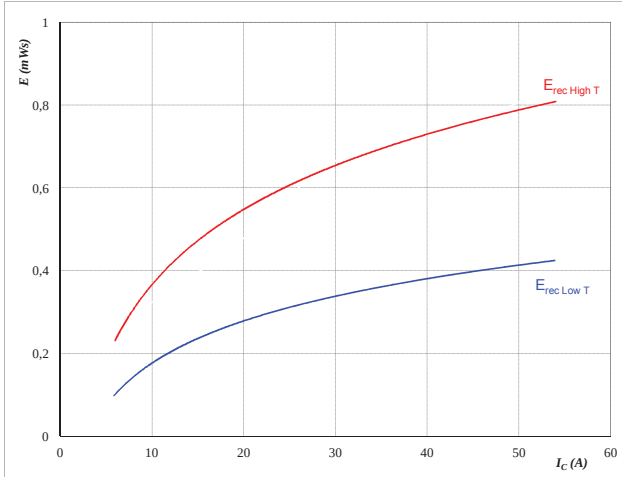
With an inductive load at

$T_J =$	25/125	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$I_C =$	29	A

Figure 6 IGBT

Typical reverse recovery energy loss
as a function of collector current

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



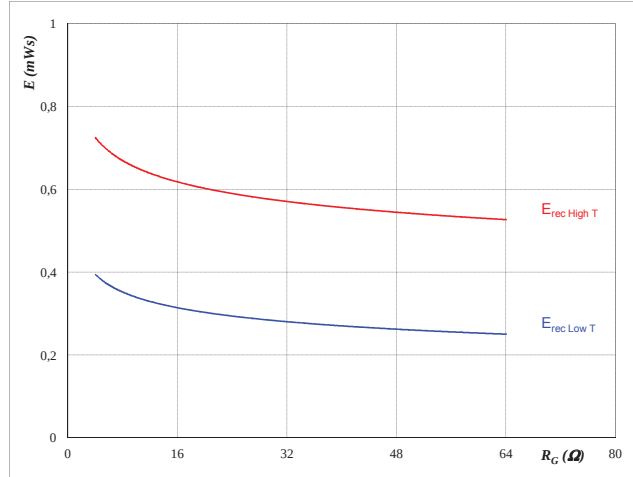
With an inductive load at

$T_J =$	25/125	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$R_{gon} =$	16	Ω

Figure 7 IGBT

Typical reverse recovery energy loss
as a function of gate resistor

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



With an inductive load at

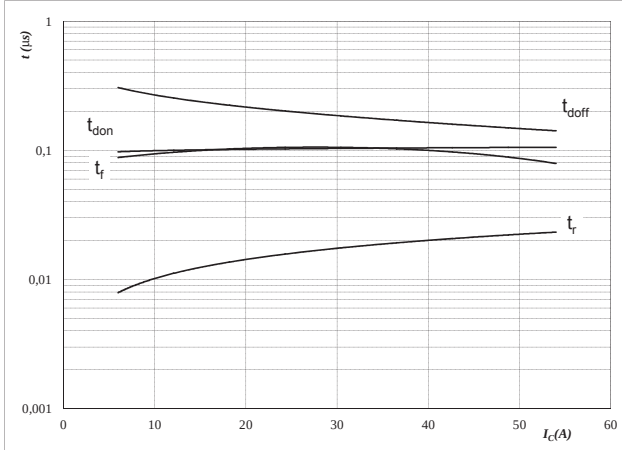
$T_J =$	25/125	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$I_C =$	29	A

Boost

Figure 8 IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



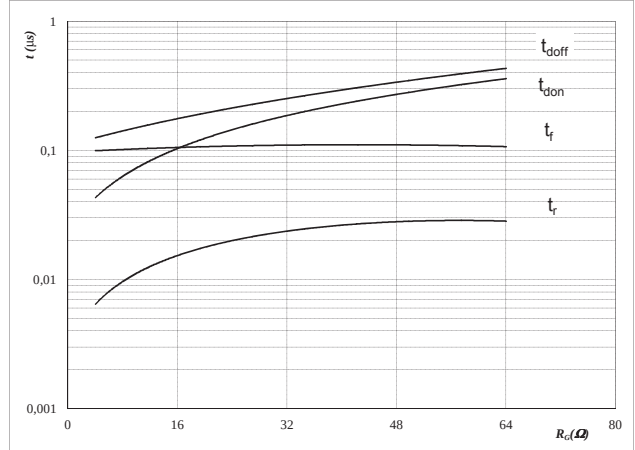
With an inductive load at

$T_J =$	125	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$R_{gon} =$	16	Ω
$R_{goff} =$	16	Ω

Figure 9 IGBT

Typical switching times as a function of gate resistor

$$t = f(R_G)$$



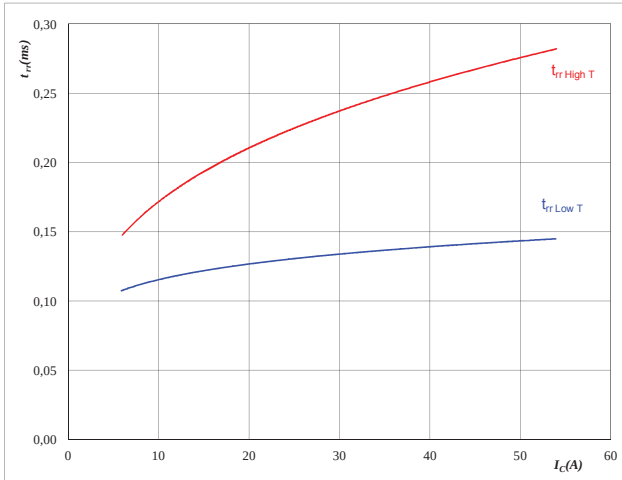
With an inductive load at

$T_J =$	125	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$I_C =$	29	A

Figure 10 FWD

Typical reverse recovery time as a function of collector current

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



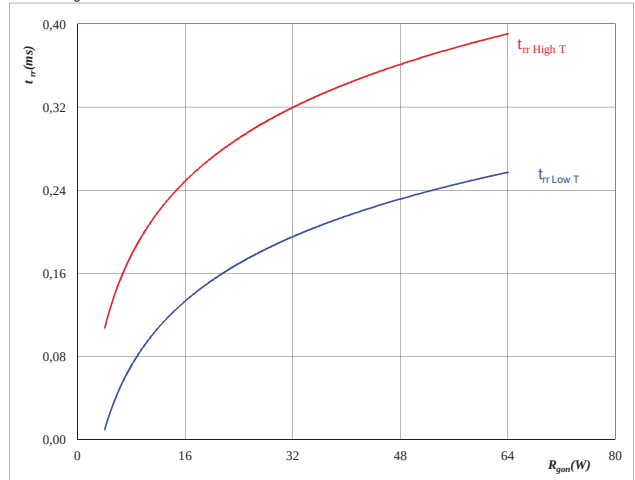
At

$T_J =$	25/125	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$R_{gon} =$	16	Ω

Figure 11 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
$V_R =$	350	V
$I_F =$	29	A
$V_{GE} =$	±15	V

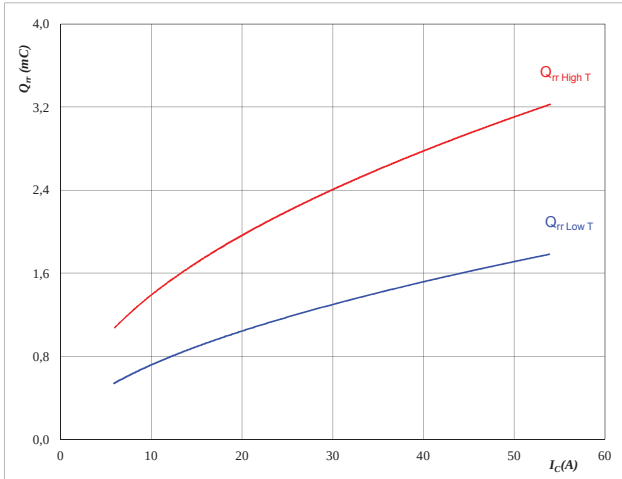
Boost

Figure 12

FWD

Typical reverse recovery charge as a function of collector current

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



At

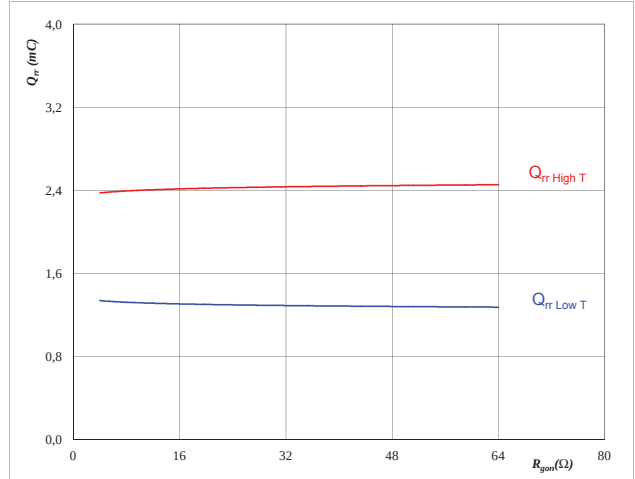
$T_J =$	25/125	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$R_{gon} =$	16	Ω

Figure 13

FWD

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

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



At

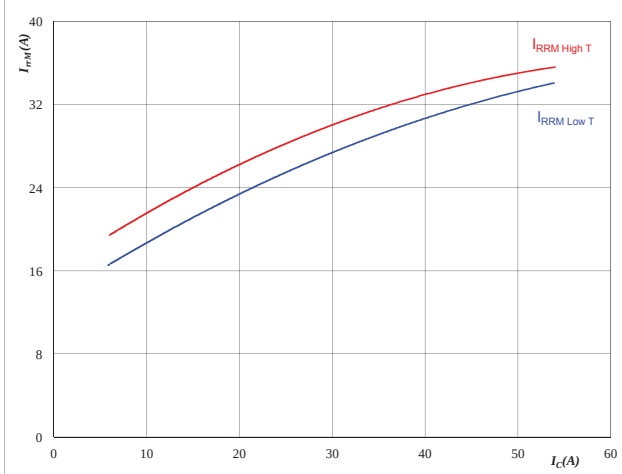
$T_J =$	25/125	°C
$V_R =$	350	V
$I_F =$	29	A
$V_{GE} =$	±15	V

Figure 14

FWD

Typical reverse recovery current as a function of collector current

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



At

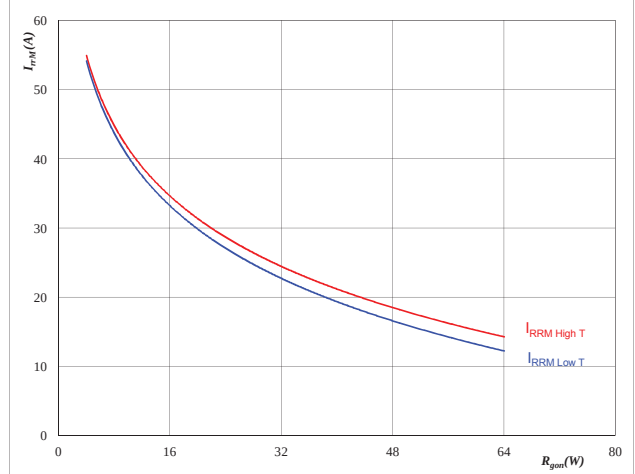
$T_J =$	25/125	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$R_{gon} =$	16	Ω

Figure 15

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
$V_R =$	350	V
$I_F =$	29	A
$V_{GE} =$	±15	V

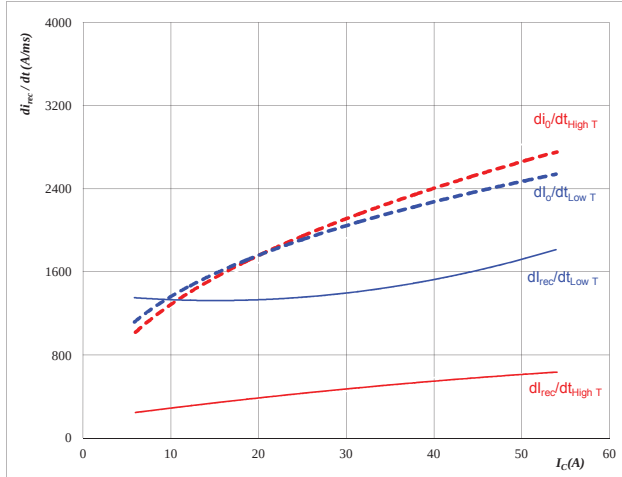
Boost

Figure 16

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

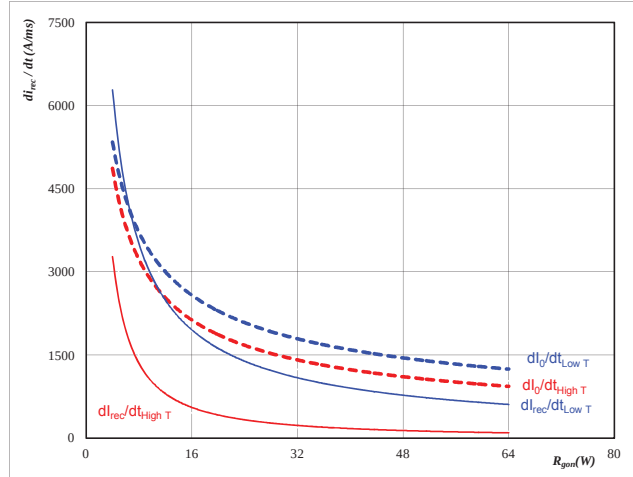
$T_J =$	25/125	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$R_{gon} =$	16	Ω

Figure 17

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

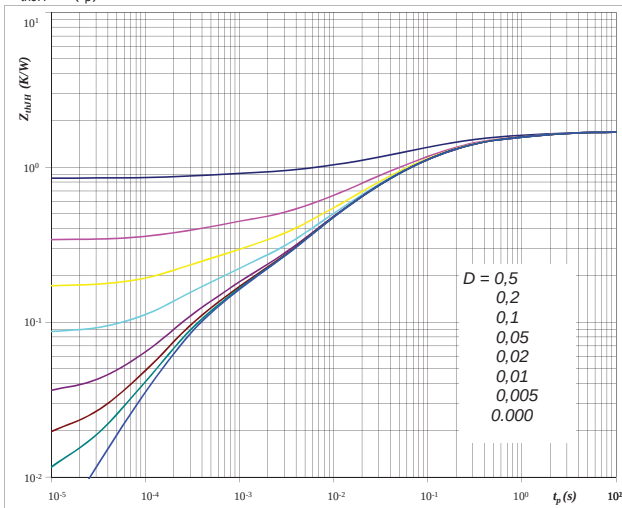
$T_J =$	25/125	°C
$V_R =$	350	V
$I_F =$	29	A
$V_{GE} =$	±15	V

Figure 18

IGBT

IGBT transient thermal impedance
as a function of pulse width

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



At

$D =$	t_p / T	
$R_{thJH} =$	1,69	K/W

R (C/W)	Tau (s)
0,05	7,4E+00
0,23	1,0E+00
0,62	1,4E-01
0,50	2,6E-02
0,18	4,3E-03
0,11	3,2E-04

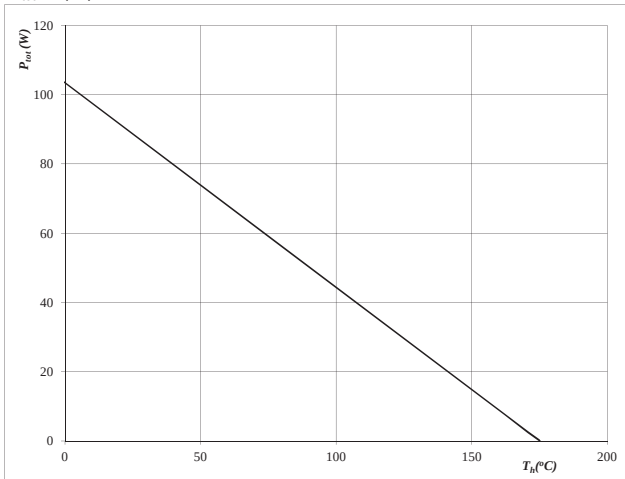
Boost

Figure 19

IGBT

Power dissipation as a function of heatsink temperature

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



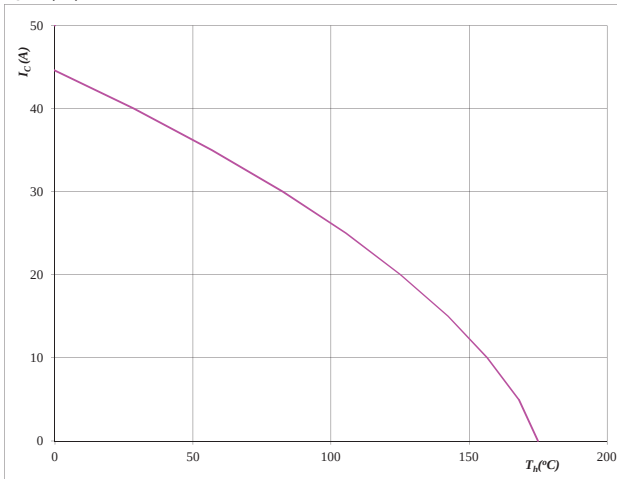
At
 $T_j = 175$ °C

Figure 20

IGBT

Collector current as a function of heatsink temperature

$$I_C = f(T_h)$$



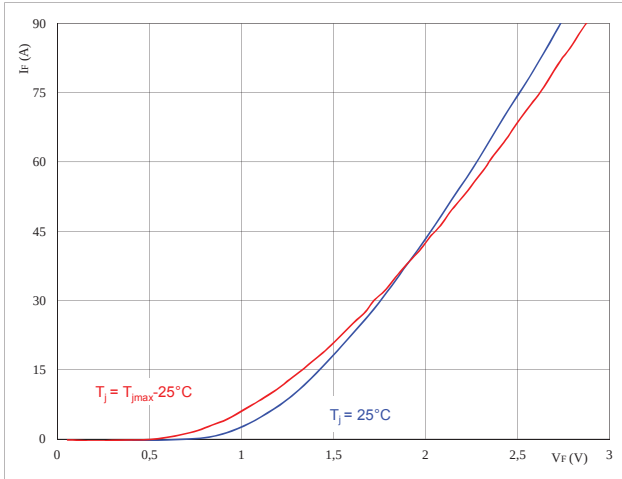
At
 $T_j = 175$ °C
 $V_{GE} = 15$ V

Buck and Boost Inverse Diode

Figure 1 Buck and Boost Inverse Diode

Typical diode forward current as a function of forward voltage

$$I_F = f(V_F)$$

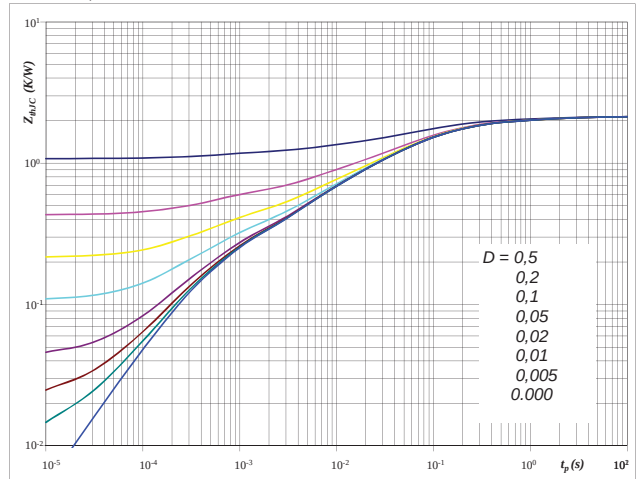


At
 $t_p = 350 \mu s$

Figure 2 Buck and Boost Inverse Diode

Diode transient thermal impedance as a function of pulse width

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

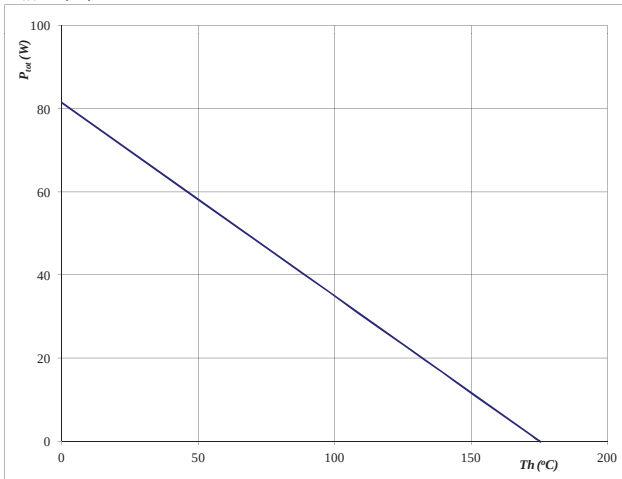


At
 $D = t_p / T$
 $R_{thJH} = 2,15 \text{ K/W}$

Figure 3 Buck and Boost Inverse Diode

Power dissipation as a function of heatsink temperature

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

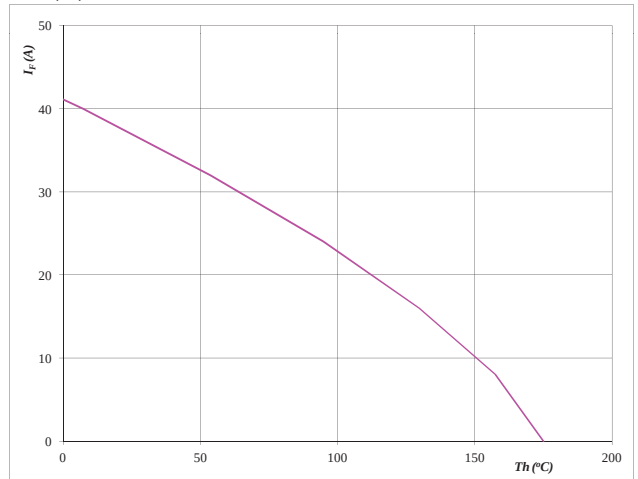


At
 $T_j = 175 \text{ °C}$

Figure 4 Buck and Boost Inverse Diode

Forward current as a function of heatsink temperature

$$I_F = f(T_h)$$



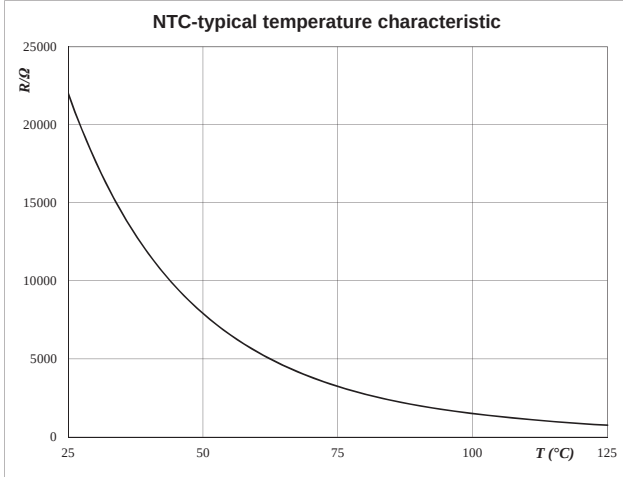
At
 $T_j = 175 \text{ °C}$

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

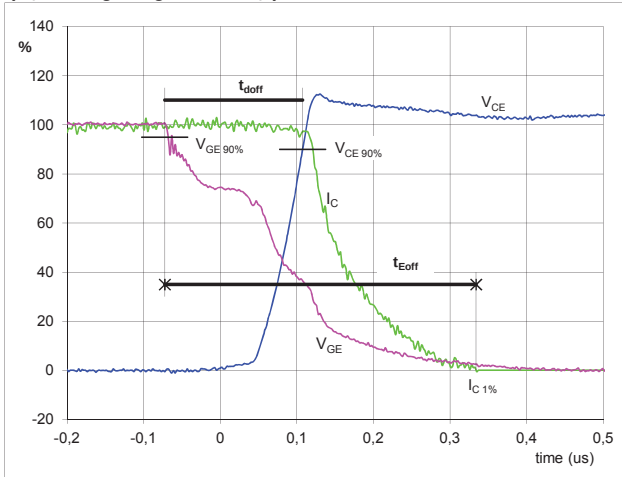
Switching Definitions BUCK IGBT

General conditions

T_j	=	125 °C
R_{gon}	=	16 Ω
R_{goff}	=	16 Ω

Figure 1 Output inverter IGBT

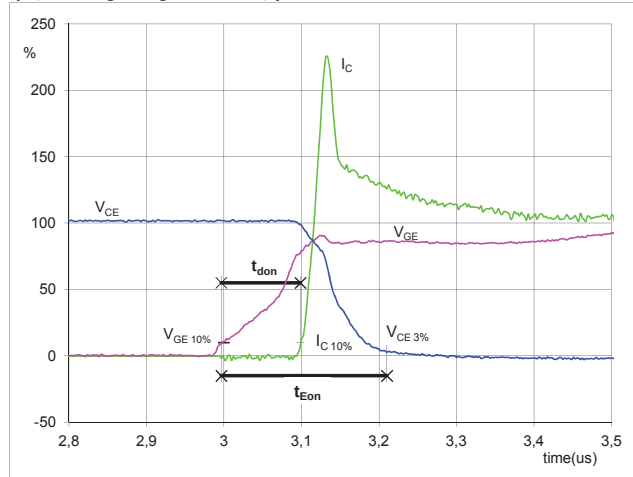
Turn-off Switching Waveforms & definition of t_{doff} , t_{Eoff}
 (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	31	A
$t_{doff} =$	0,17	μs
$t_{Eoff} =$	0,41	μs

Figure 2 Output inverter IGBT

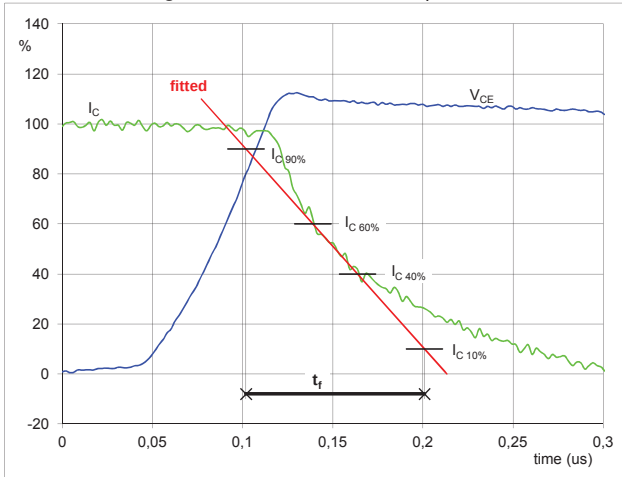
Turn-on Switching Waveforms & definition of t_{don} , t_{Eon}
 (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	31	A
$t_{don} =$	0,10	μs
$t_{Eon} =$	0,21	μs

Figure 3 Output inverter IGBT

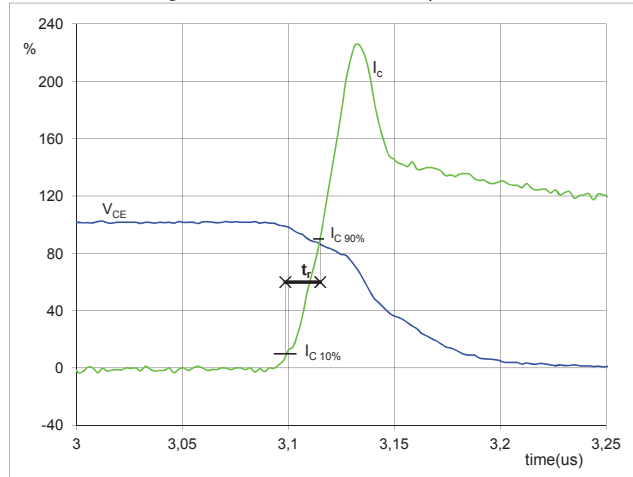
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%) =$	350	V
$I_C(100\%) =$	31	A
$t_f =$	0,11	μs

Figure 4 Output inverter IGBT

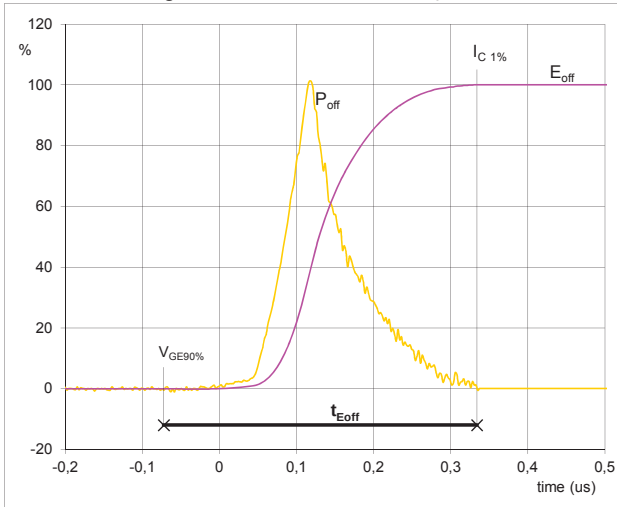
Turn-on Switching Waveforms & definition of t_r



$V_C(100\%) =$	350	V
$I_C(100\%) =$	31	A
$t_r =$	0,02	μs

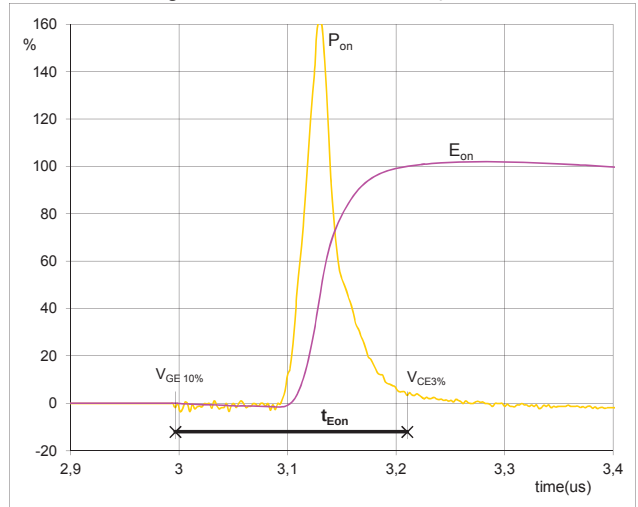
Switching Definitions BUCK IGBT

Figure 5 Output inverter IGBT
Turn-off Switching Waveforms & definition of t_{Eoff}



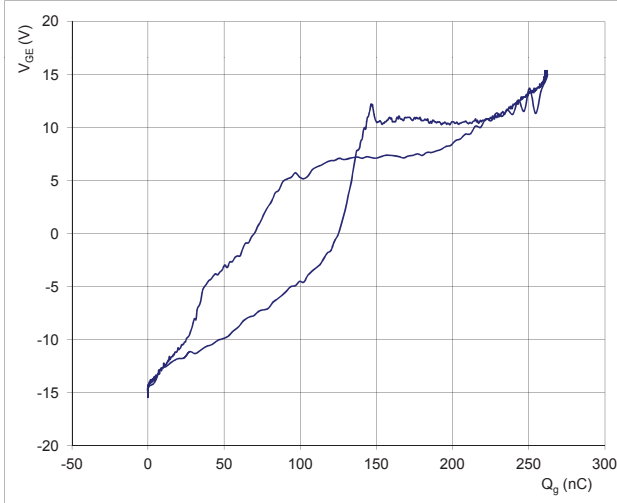
$P_{off}(100\%) = 10,70$ kW
 $E_{off}(100\%) = 1,02$ mJ
 $t_{Eoff} = 0,41$ μ s

Figure 6 Output inverter IGBT
Turn-on Switching Waveforms & definition of t_{Eon}



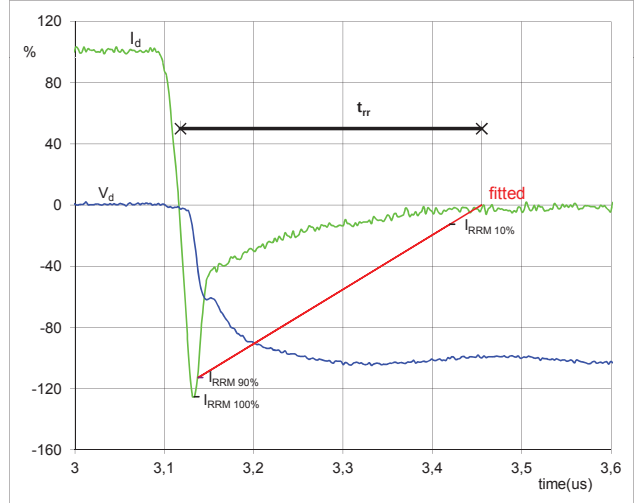
$P_{on}(100\%) = 10,70$ kW
 $E_{on}(100\%) = 0,62$ mJ
 $t_{Eon} = 0,21$ μ s

Figure 7 Output inverter FWD
Gate voltage vs Gate charge (measured)



$V_{GEoff} = -15$ V
 $V_{GEon} = 15$ V
 $V_C(100\%) = 350$ V
 $I_C(100\%) = 31$ A
 $Q_g = 261,94$ nC

Figure 8 Output inverter IGBT
Turn-off Switching Waveforms & definition of t_{rr}

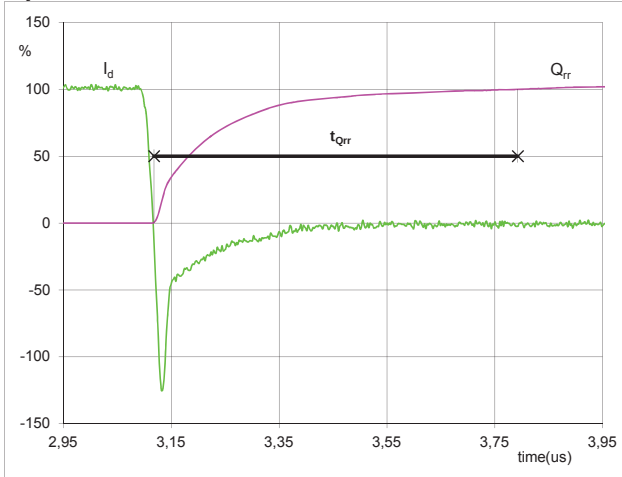


$V_d(100\%) = 350$ V
 $I_d(100\%) = 31$ A
 $I_{RRM}(100\%) = -39$ A
 $t_{rr} = 0,18$ μ s

Switching Definitions BUCK IGBT

Figure 9 Output inverter FWD

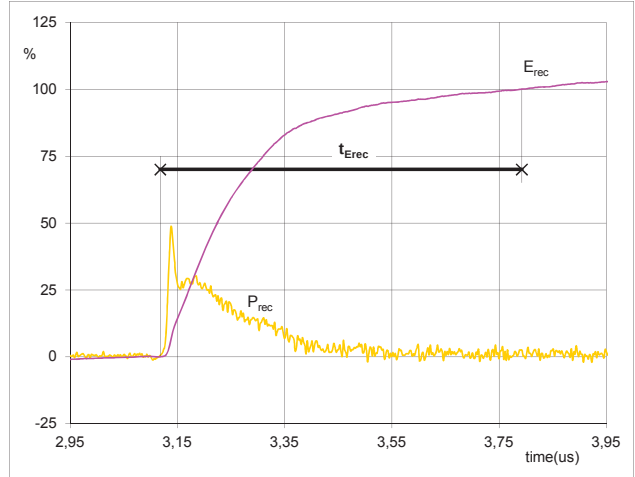
Turn-on Switching Waveforms & definition of t_{Qrr}
 (t_{Qrr} = integrating time for Q_{rr})



I_d (100%) = 31 A
 Q_{rr} (100%) = 2,29 μ C
 t_{Qrr} = 0,67 μ s

Figure 10 Output inverter FWD

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

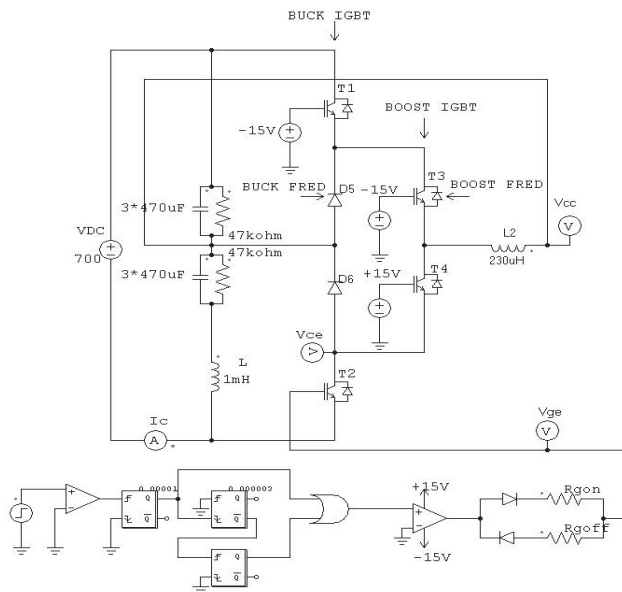


P_{rec} (100%) = 10,70 kW
 E_{rec} (100%) = 0,55 mJ
 t_{Erec} = 0,67 μ s

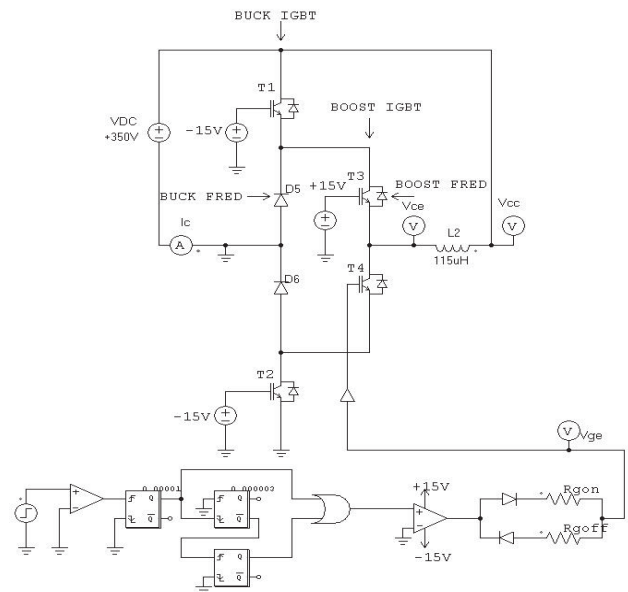
Measurement circuits

Figure 11

BUCK stage switching measurement circuit


Figure 12

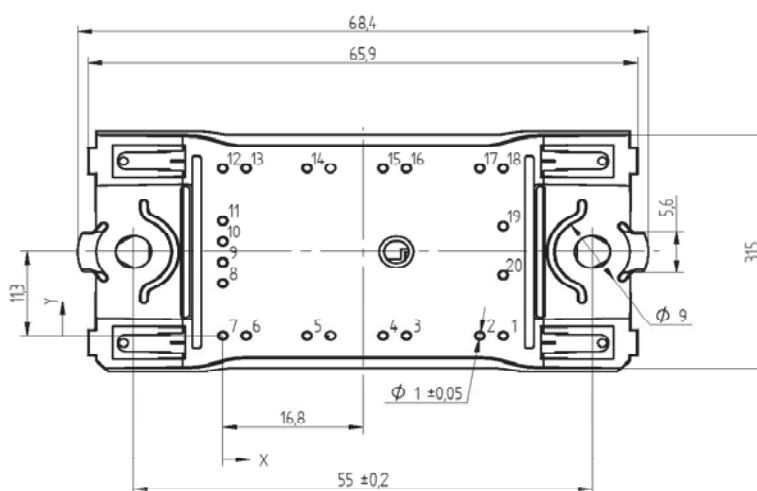
BOOST stage switching measurement circuit



Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
Standard in flow0 12mm housing	10-FZ06NIA030SA-P924F33	P924F33	P924F33

Pin table		
Pin	X	Y
1	33,6	0
2	30,8	0
3	22	0
4	19,2	0
5	10,1	0
6	2,8	0
7	0	0
8	0	7,1
9	0	9,9
10	0	12,7
11	0	15,5
12	0	22,6
13	2,8	22,6
14	10,1	22,6
15	19,2	22,6
16	22	22,6
17	30,8	22,6
18	33,6	22,6
19	33,6	14,8
20	33,6	8,2



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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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.