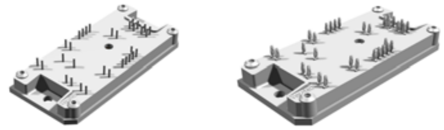
Vincotech

10-FY12NMA080SH-M427F
10-PY12NMA080SH-M427FY
preliminary datasheet

flowMNPC 1 **1200V/80A**

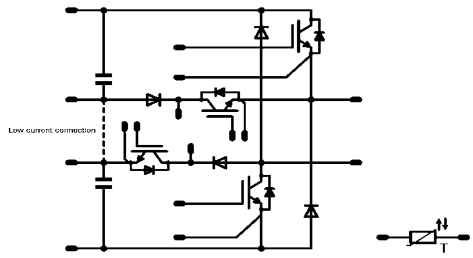
Features
- mixed voltage NPC topology
- reactive power capability
- low inductance layout
- Split output
- Common collector neutral connection

flow0 12mm housing



Target Applications
- solar inverter
- UPS
- Active frontend

Schematic



Types
- 10-FY12NMA080SH-M427F
- 10-PY12NMA080SH-M427FY

Maximum Ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Halfbridge IGBT Inverse Diode					
Repetitive peak reverse voltage	V_{RRM}	T_j=25°C		1200	V
DC forward current	I_F	T_j=$T_j$max	T_h=80°C T_c=80°C	12 17	A
Repetitive peak forward current	I_{FRM}	tp=10ms		14	A
Maximum Junction Temperature	P_{tot}		T_h=80°C T_c=80°C	27 42	W
Maximum Junction Temperature	Tjmax			150	°C
Halfbridge IGBT					
Collector-emitter break down voltage	V_{DS}			1200	V
DC collector current	I_D	T_j=$T_j$max	T_h=80°C T_c=80°C	62 80	A
Repetitive peak collector current	I_{Dpulse}	t_p limited by $T_j$max		240	A
Power dissipation per IGBT	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	133 201	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j≤150°C V_{GE}=15V		10 800	μs V
Maximum Junction Temperature	$T_j$max			175	°C

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
NP Diode					
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25°C		1200	V
DC forward current	I_F	T_j=$T_j$max	T_h=80°C T_c=80°C	50 67	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max	T_c=100°C	120	A
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	61 92	W
Maximum Junction Temperature	$T_j$max			175	°C
NP IGBT					
Collector-emitter break down voltage	V_{CE}			600	V
DC collector current	I_C	T_j=$T_j$max	T_h=80°C T_c=80°C	51 71	A
Repetitive peak collector current	I_{Cpuls}	t_p limited by $T_j$max		225	A
Power dissipation per IGBT	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	76 116	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	$T_j$max			175	°C
NP Inverse Diode					
Peak Repetitive Reverse Voltage	V_{RRM}	T_c=25°C		600	V
DC forward current	I_F	T_j=$T_j$max	T_h=80°C T_c=80°C	19 25	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		30	A
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	29 44	W
Maximum Junction Temperature	$T_j$max			185	°C
Halfbridge Diode					
Peak Repetitive Reverse Voltage	V_{RRM}	T_j=25°C		1200	V
DC forward current	I_F	T_j=$T_j$max	T_h=80°C T_c=80°C	31 41	A
Repetitive peak forward current	I_{FRM}	t_p limited by $T_j$max		200	A
Power dissipation per Diode	P_{tot}	T_j=$T_j$max	T_h=80°C T_c=80°C	62 94	W
Maximum Junction Temperature	$T_j$max			175	°C

Maximum Ratings

Tj=25°C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
DC link Capacitor				
Max.DC voltage	V_{MAX}	Tc=25°C	630	V
Thermal Properties				
Storage temperature	T_{stg}		-40…+125	°C
Operation temperature under switching condition	T_{op}		-40…+(Tjmax - 25)	°C
Insulation Properties				
Insulation voltage	V_{is}	t=2s DC voltage	4000	V
Creepage distance			min 12,7	mm
Clearance			min 12,7	mm
Comparative tracking index	CTI		>200	

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_D [A]	T_j	Min	Typ	Max	
Halfbridge IGBT Inverse Diode										
Forward voltage	V_f				7	Tj=25°C Tj=125°C		2,03 1,67		V
Threshold voltage (for power loss calc. only)	V_{to}				7	Tj=25°C Tj=125°C		1,35 1,00		V
Slope resistance (for power loss calc. only)	r_t				7	Tj=25°C Tj=125°C		0,10 0,10		Ω
Reverse current	I_r			1200		Tj=25°C Tj=125°C			0,25	mA
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						2,55		K/W
Thermal resistance chip to case per chip	R_{thJC}							1,68		
Halfbridge IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,0015	Tj=25°C Tj=150°C	5,2	5,8	6,4	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		80	Tj=25°C Tj=150°C	1,7	2,05 2,37	2,4	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	1200		Tj=25°C Tj=150°C			0,01	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=150°C			240	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(ON)}$	Rgoff=8 Ω Rgon=8 Ω	±15	350	50	Tj=25°C Tj=150°C		125 127		ns
Rise time	t_r					Tj=25°C Tj=150°C		23 26		
Turn-off delay time	$t_{d(OFF)}$					Tj=25°C Tj=150°C		215 271		
Fall time	t_f					Tj=25°C Tj=150°C		38 72		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=150°C		0,97 1,64		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=150°C		1,28 2,00		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C Tj=150°C		4600		pF
Output capacitance	C_{oos}					Tj=25°C Tj=150°C		300		
Reverse transfer capacitance	C_{rrs}					Tj=25°C Tj=150°C		270		
Gate charge	Q_{Gate}		±15	960	80	Tj=25°C Tj=150°C		370		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						0,71		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,47		
*additional value stands for built-in capacitor										
NP Diode										
Diode forward voltage	V_F				50	Tj=25°C Tj=150°C		1,97 1,46	2,74	V
Peak reverse recovery current	I_{RRM}	Rgon=8 Ω	±15	350	50	Tj=25°C Tj=150°C		38 56		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C		30 118		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=150°C		0,83 2,73		μC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=150°C		4124 2769		A/μs
Reverse recovered energy	Erec					Tj=25°C Tj=150°C		0,10 0,41		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,56		K/W
Thermal resistance chip to case per chip	R_{thJC}							1,03		

Characteristic Values

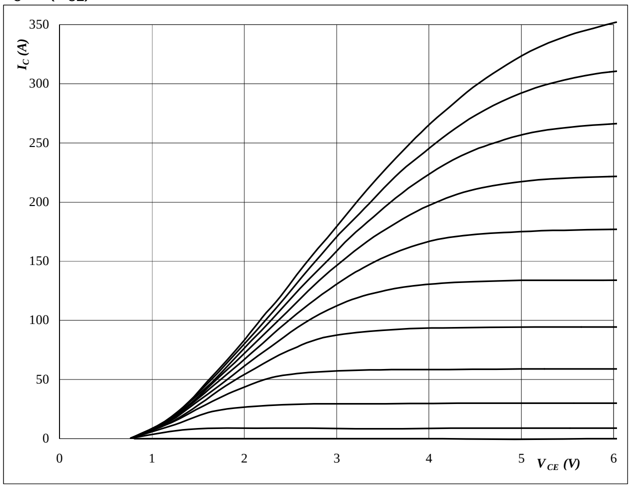
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] or V_{GS} [V]	V_r [V] or V_{CE} [V] or V_{DS} [V]	I_C [A] or I_F [A] or I_D [A]	T_j	Min	Typ	Max	
NP IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}$			0,0012	Tj=25°C Tj=150°C	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		75	Tj=25°C Tj=150°C	1,05	1,45 1,60	1,85	V
Collector-emitter cut-off incl diode	I_{CES}		0	600		Tj=25°C Tj=150°C			0,0038	mA
Gate-emitter leakage current	I_{GES}		20	0		Tj=25°C Tj=150°C			600	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	Rgoff=8 Ω Rgon=8 Ω	±15	350	50	Tj=25°C Tj=150°C		145 151		ns
Rise time	t_r					Tj=25°C Tj=150°C		22 24		
Turn-off delay time	$t_{d(off)}$					Tj=25°C Tj=150°C		212 250		
Fall time	t_f					Tj=25°C Tj=150°C		151 119		
Turn-on energy loss per pulse	E_{on}					Tj=25°C Tj=150°C		1,12 1,39		mWs
Turn-off energy loss per pulse	E_{off}					Tj=25°C Tj=150°C		1,71 2,32		
Input capacitance	C_{ies}	f=1MHz	0	25		Tj=25°C		4620		pF
Output capacitance	C_{oss}							288		
Reverse transfer capacitance	C_{rss}							137		
Gate charge	Q_{Gate}		±15	480	75			470		nC
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,25		K/W
Thermal resistance chip to case per chip	R_{thJC}							0,82		
NP Inverse Diode										
Diode forward voltage	V_F				15	Tj=25°C Tj=125°C	1,3	1,6 1,5	2,0	V
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						3,24		K/W
Thermal resistance chip to case per chip	R_{thJC}							2,14		
Halfbridge Diode										
Diode forward voltage	V_F				60	Tj=25°C Tj=150°C		2,49 3,02	1,68	V
Reverse leakage current	I_r			600		Tj=25°C Tj=150°C			50	µA
Peak reverse recovery current	I_{RRM}	Rgon=8 Ω	±15	350	50	Tj=25°C Tj=150°C		52 61		A
Reverse recovery time	t_{rr}					Tj=25°C Tj=150°C		52 286		ns
Reverse recovered charge	Q_{rr}					Tj=25°C Tj=150°C		3,26 6,56		µC
Peak rate of fall of recovery current	di(rec)max /dt					Tj=25°C Tj=150°C		1921 4562		A/µs
Reverse recovery energy	E_{rec}					Tj=25°C Tj=150°C		0,75 1,72		mWs
Thermal resistance chip to heatsink per chip	R_{thJH}	Thermal grease thickness≤50um λ = 1 W/mK						1,54		K/W
Thermal resistance chip to case per chip	R_{thJC}							1,02		
DC link Capacitor										
C value	C							100		nF
Thermistor										
Rated resistance	R					Tj=25°C		22000		Ω
Deviation of R25	ΔR/R	R100=1486 Ω				Tc=100°C	-5		+5	%
Power dissipation	P					Tj=25°C		200		mW
Power dissipation constant						Tj=25°C		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				Tj=25°C		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				Tj=25°C		3996		K
Vincotech NTC Reference						Tj=25°C			B	

Half Bridge

Figure 1 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



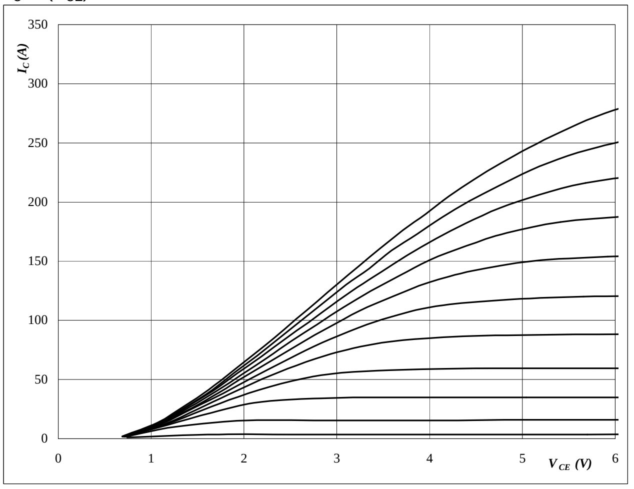
At

t_p =	250	μs
T_j =	25	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 2 IGBT

Typical output characteristics

$I_C = f(V_{CE})$



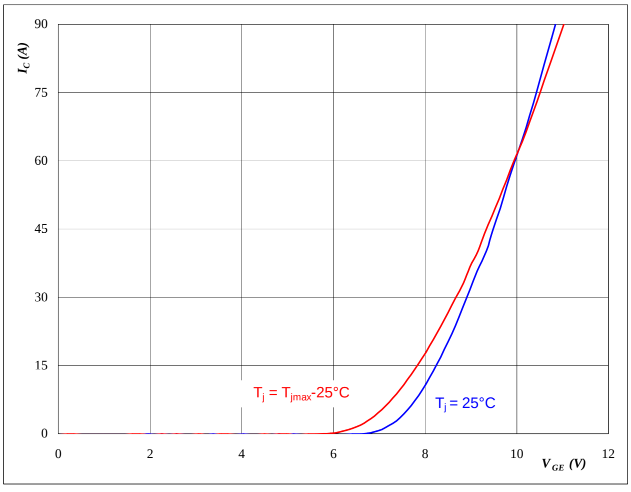
At

t_p =	250	μs
T_j =	125	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 3 IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



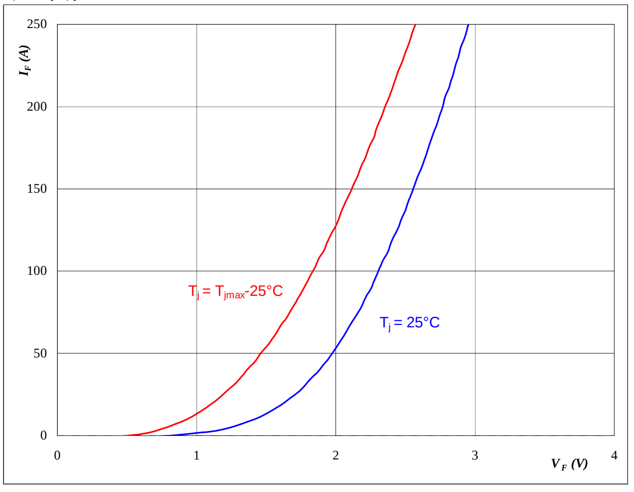
At

t_p =	250	μs
V_{CE} =	10	V
T_j =	25/125	°C

Figure 4 FWD

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



At

t_p =	250	μs
T_j =	25/125	°C

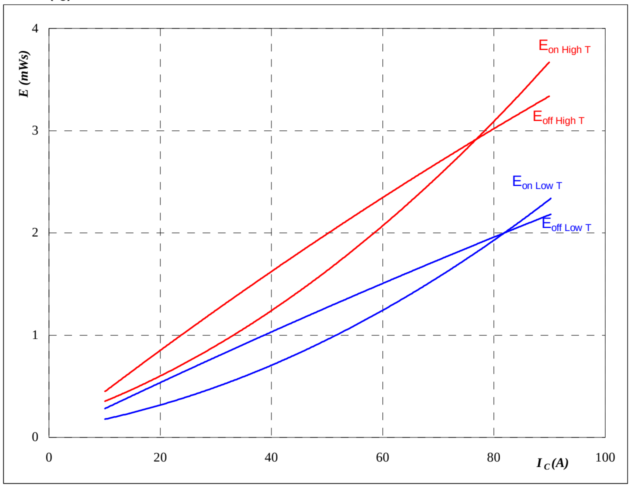
Half Bridge

half bridge IGBT and NP FWD

Figure 5 IGBT

Typical switching energy losses
as a function of collector current

E = f(I_C)



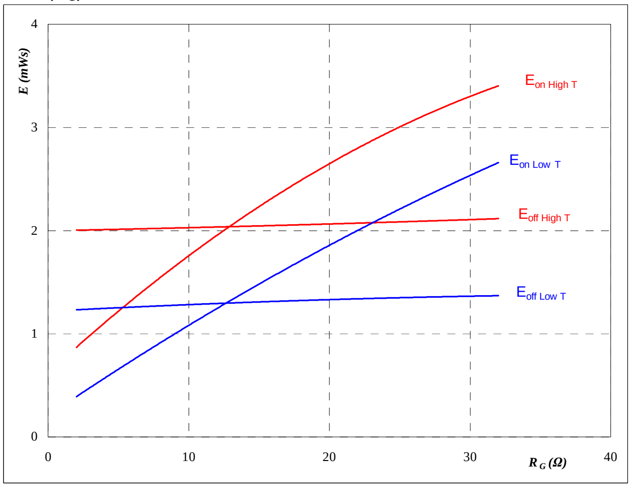
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 6 IGBT

Typical switching energy losses
as a function of gate resistor

E = f(R_G)



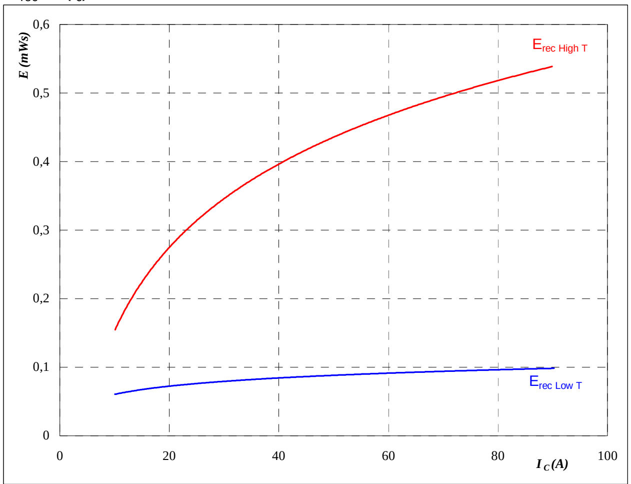
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	50	A

Figure 7 FWD

Typical reverse recovery energy loss
as a function of collector current

E_{rec} = f(I_c)



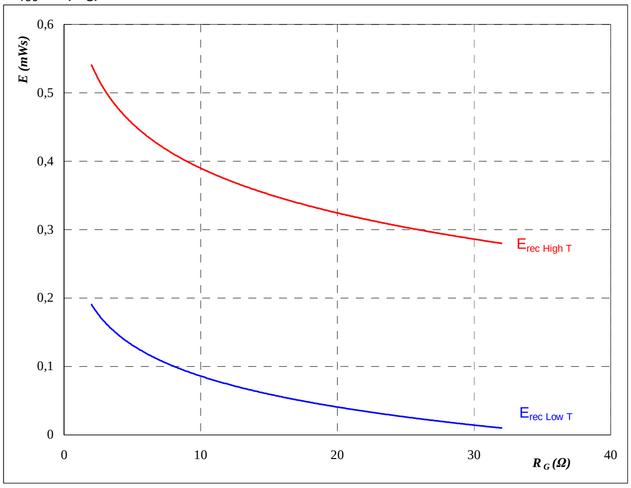
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	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 =	50	A

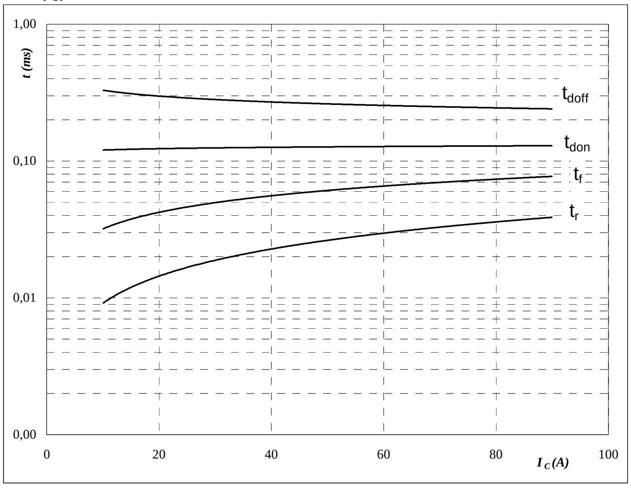
Half Bridge

half bridge IGBT and NP FWD

Figure 9 IGBT

Typical switching times as a function of collector current

t = f(I_C)



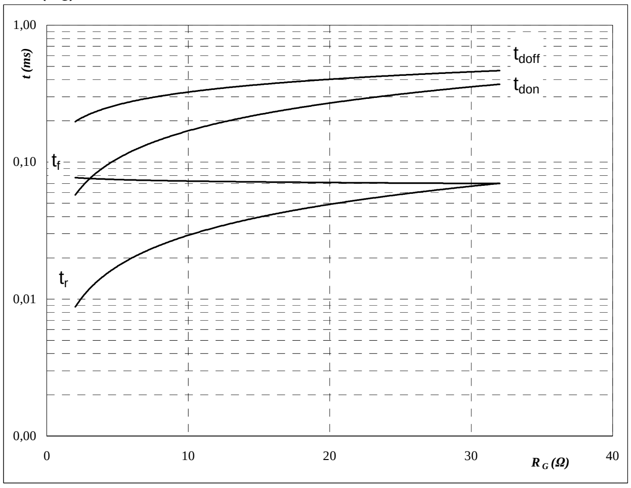
With an inductive load at

T_j =	125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 10 IGBT

Typical switching times as a function of gate resistor

t = f(R_G)



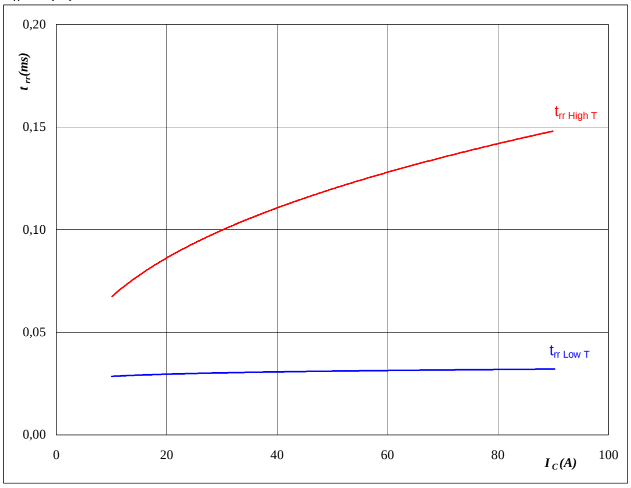
With an inductive load at

T_j =	125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	50	A

Figure 11 FWD

Typical reverse recovery time as a function of collector current

t_{rr} = f(Ic)



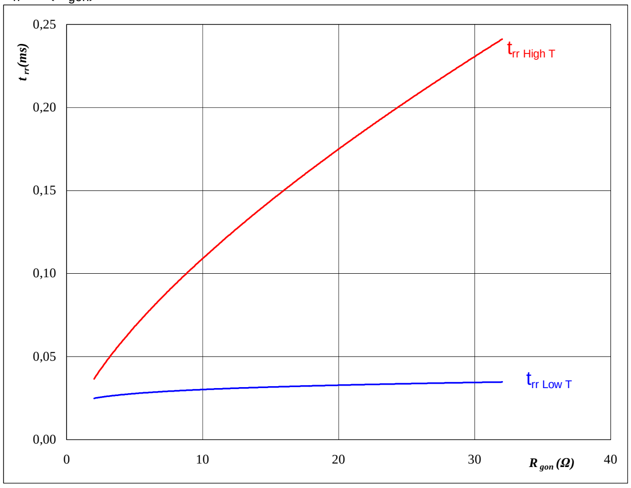
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 12 FWD

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

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



At

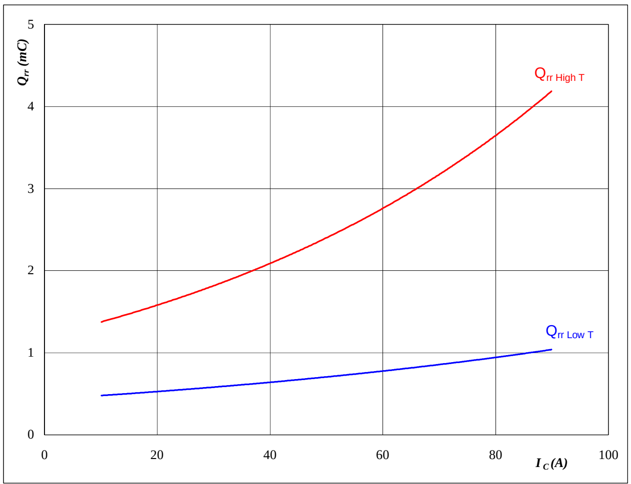
T_j =	25/125	°C
V_R =	350	V
I_F =	50	A
V_{GE} =	±15	V

Half Bridge

Figure 13 FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



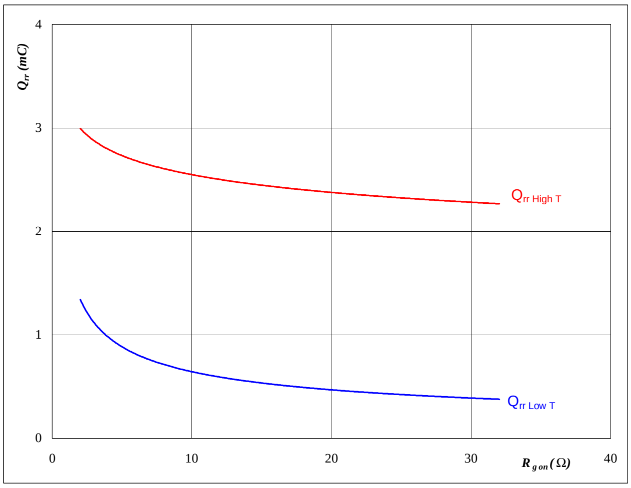
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 14 FWD

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

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



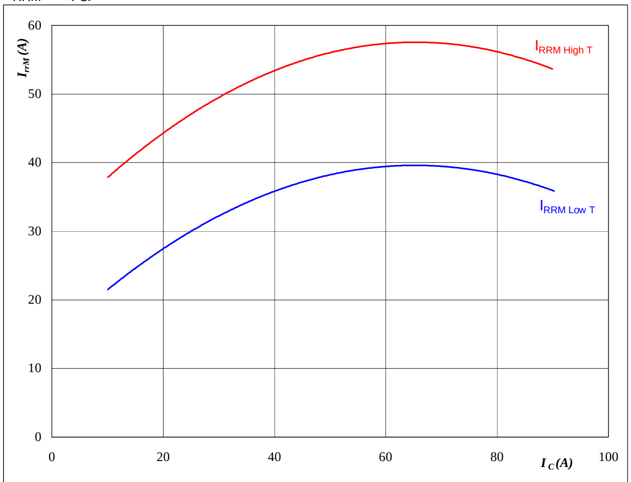
At

T_j =	25/125	°C
V_R =	350	V
I_F =	50	A
V_{GE} =	±15	V

Figure 15 FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



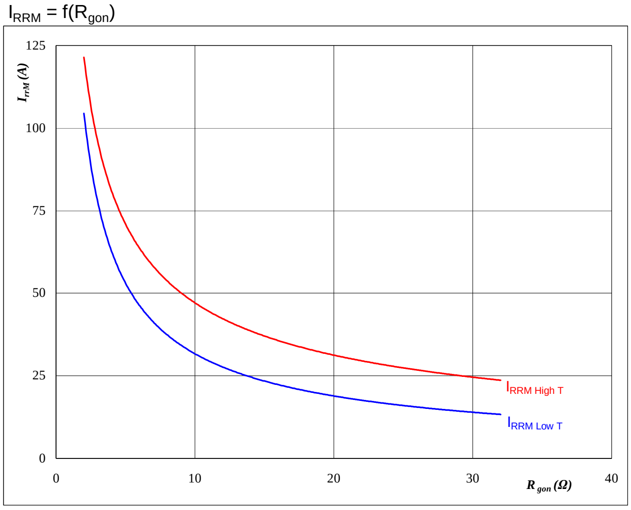
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 16 FWD

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

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



At

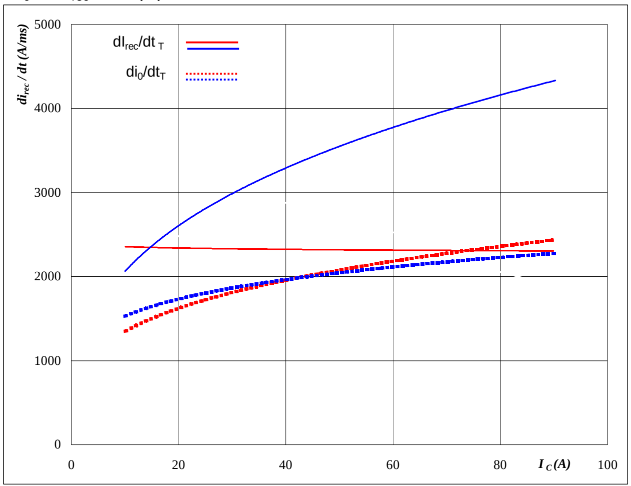
T_j =	25/125	°C
V_R =	350	V
I_F =	50	A
V_{GE} =	±15	V

Half Bridge

Figure 17 FWD

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

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



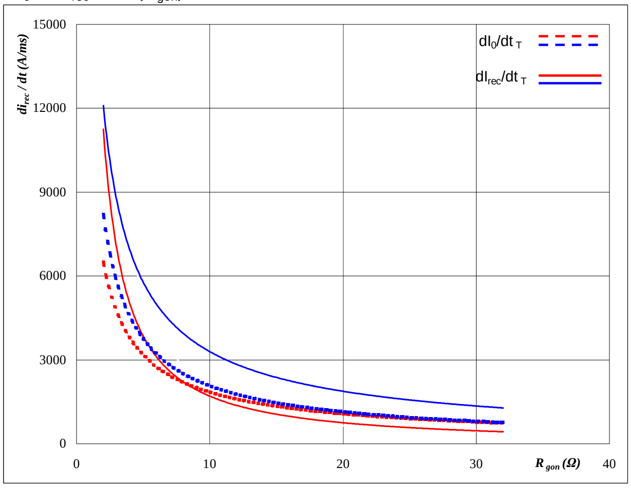
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω

Figure 18 FWD

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

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



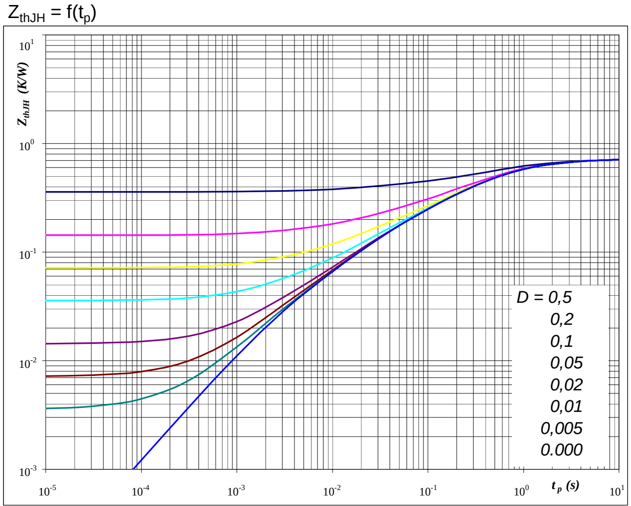
At

T_j =	25/125	°C
V_R =	350	V
I_F =	50	A
V_{GE} =	±15	V

Figure 19 IGBT

JFET transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	t_p / T	
R_{thJH} =	0,71	K/W

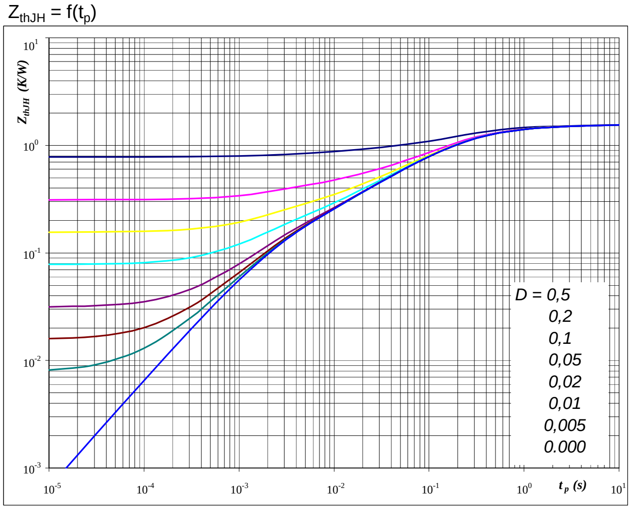
JFET thermal model values

R (C/W)	Tau (s)
0,11	2,9E+00
0,23	6,9E-01
0,22	2,5E-01
0,08	6,2E-02
0,06	1,7E-02
0,02	2,5E-03

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} =	1,56	K/W

FWD thermal model values

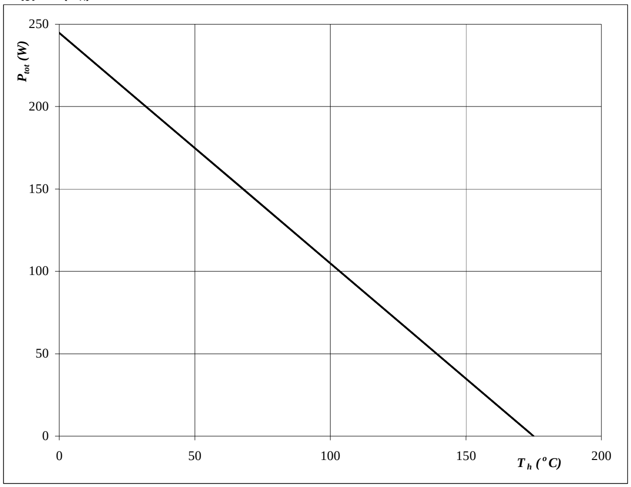
R (C/W)	Tau (s)
0,07	5,9E+00
0,19	1,1E+00
0,65	2,3E-01
0,39	7,4E-02
0,16	1,4E-02
0,10	2,1E-03

Half Bridge

Figure 21 IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



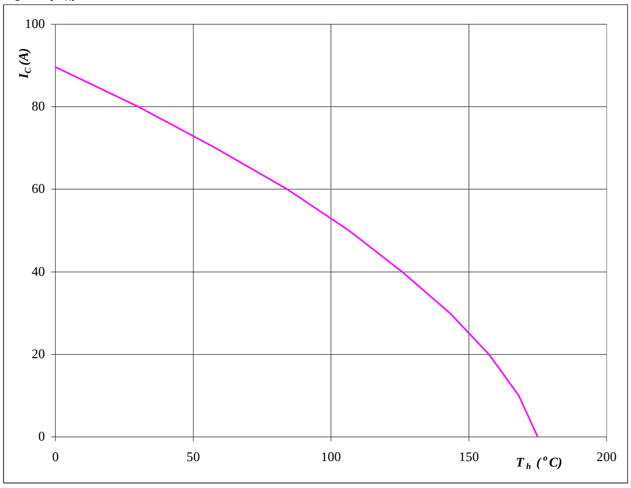
At

T_j = 175 °C

Figure 22 IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



At

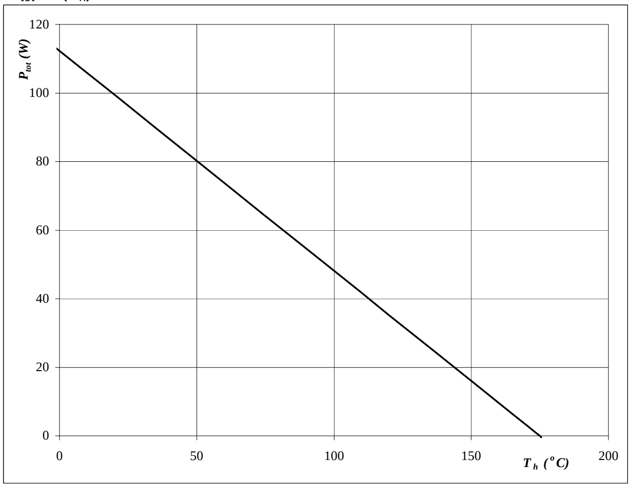
T_j = 175 °C

V_{GE} = 15 V

Figure 23 FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



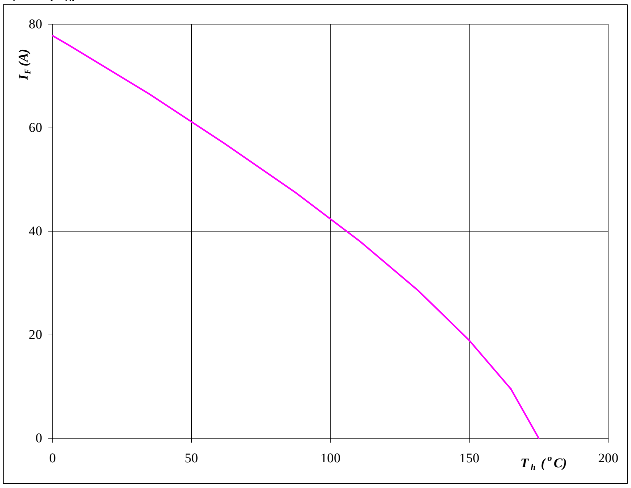
At

T_j = 175 °C

Figure 24 FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

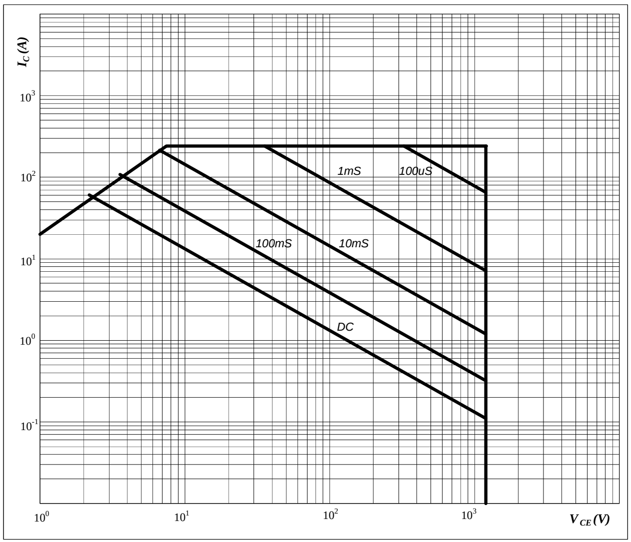
T_j = 175 °C

Half Bridge

Figure 25 IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



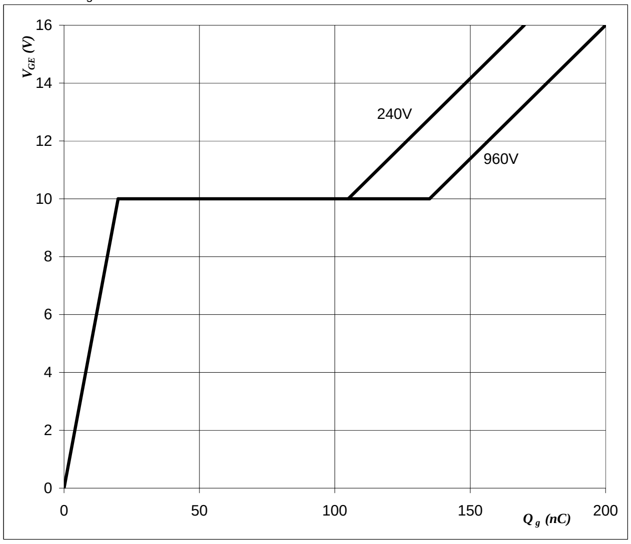
At

D =	single pulse	
Th =	80	ºC
V_{GE} =	0	V
T_j =	T_{jmax}	ºC

Figure 26 IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



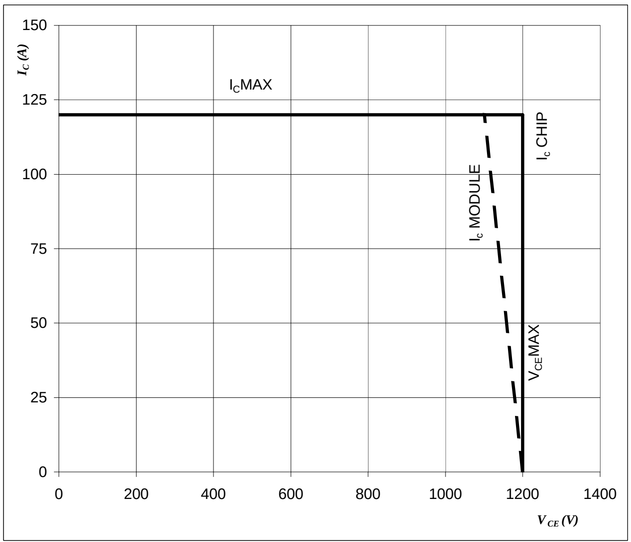
At

I_D =	20	A
V_{DS}=	600	V
T_j=	25	ºC

Figure 27 IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	T_{jmax}-25	ºC
$U_{ccminus}$=U_{ccplus}		
Switching mode :	3 level switching	

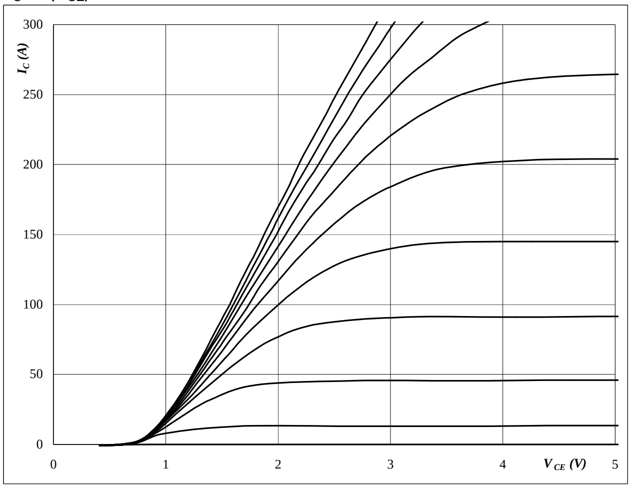
NP IGBT

neutral point IGBT and half bridge FWD

Figure 1 NP IGBT

Typical output characteristics

$I_C = f(V_{CE})$



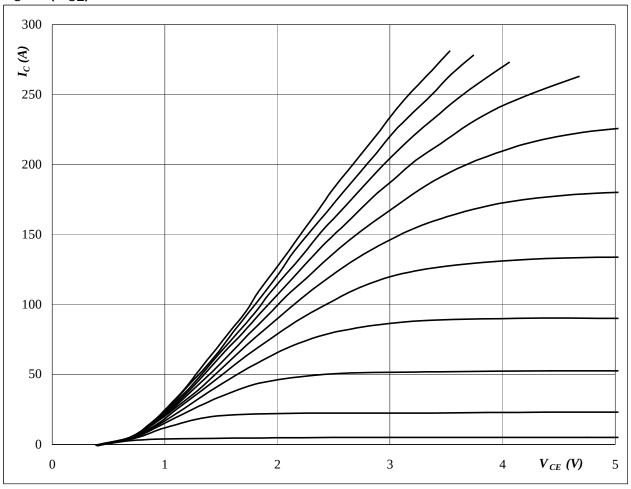
At

t_p =	250	µs
T_j =	25	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 2 NP IGBT

Typical output characteristics

$I_C = f(V_{CE})$



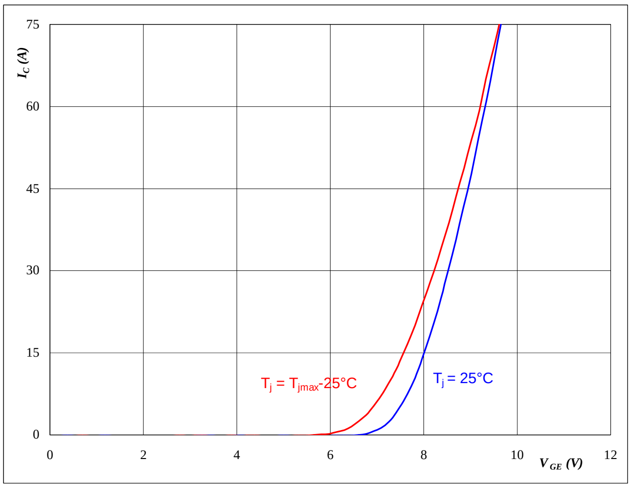
At

t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

Figure 3 NP IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$



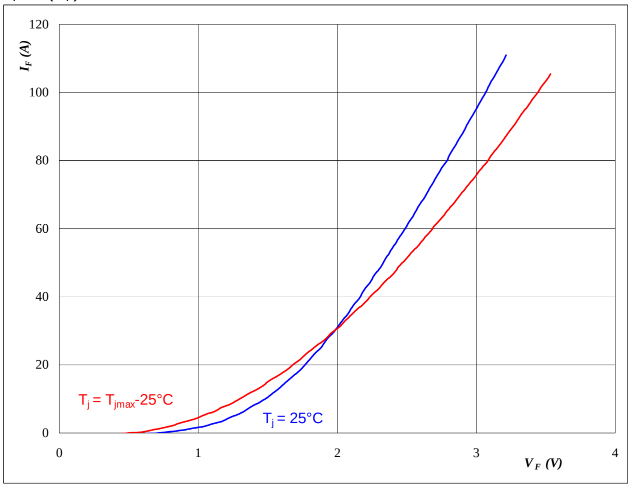
At

t_p =	250	µs
V_{CE} =	10	V
T_j =	25/125	°C

Figure 4 FWD

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



At

t_p =	250	µs
T_j =	25/125	°C

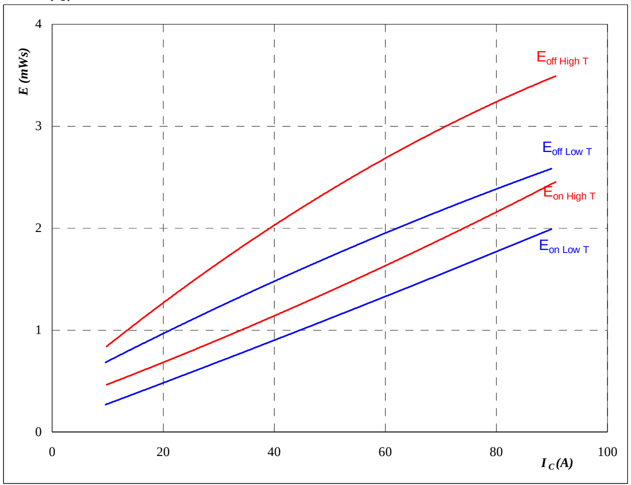
NP IGBT

neutral point IGBT and half bridge FWD

Figure 5 — NP IGBT

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



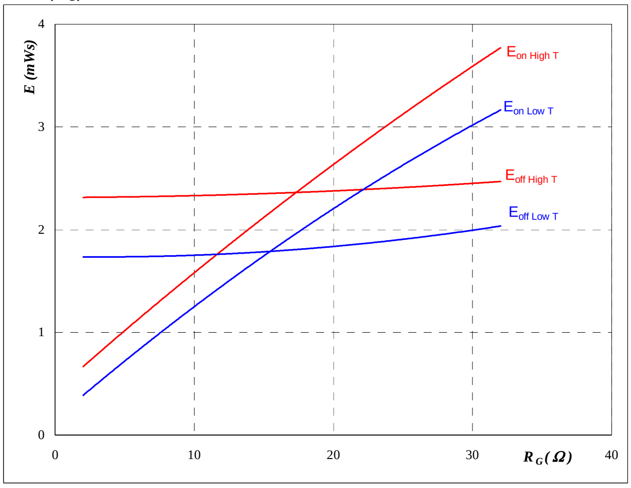
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 6 — NP IGBT

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



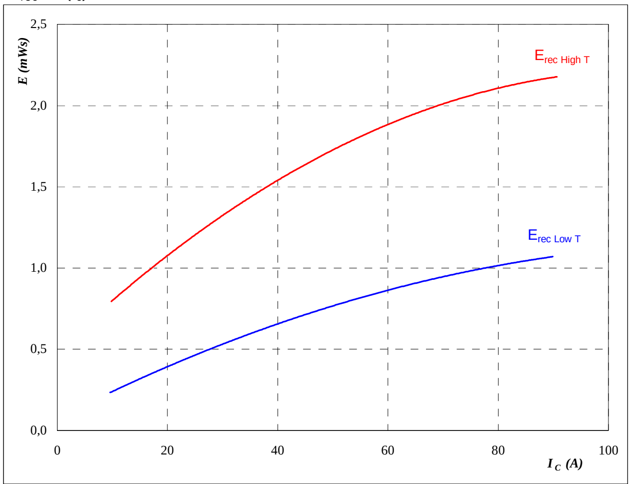
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	50	A

Figure 7 — FWD

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_c)$



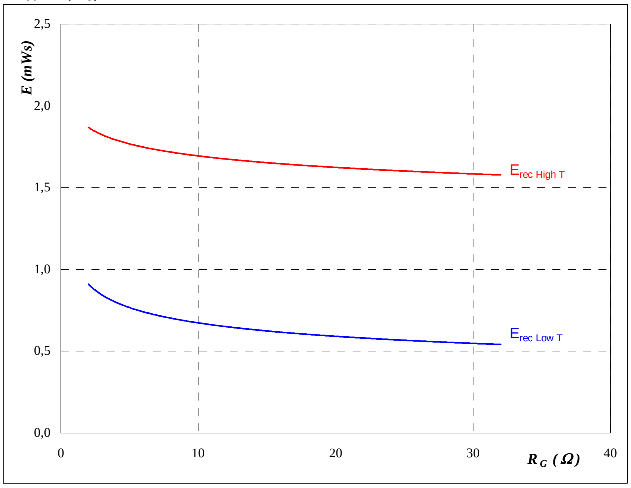
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	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 =	50	A

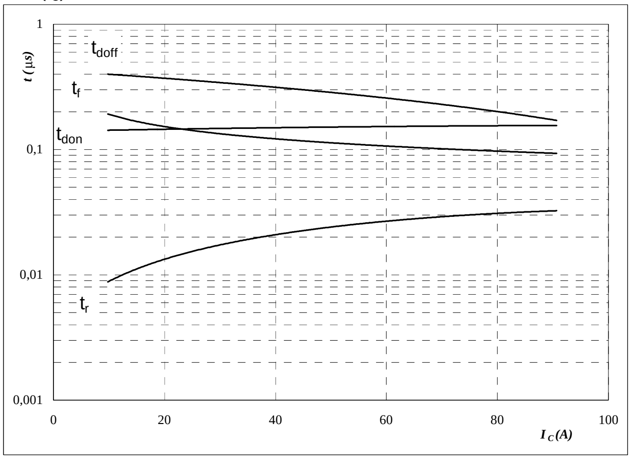
NP IGBT

neutral point IGBT and half bridge FWD

Figure 9 NP IGBT

Typical switching times as a function of collector current

t = f(I_C)



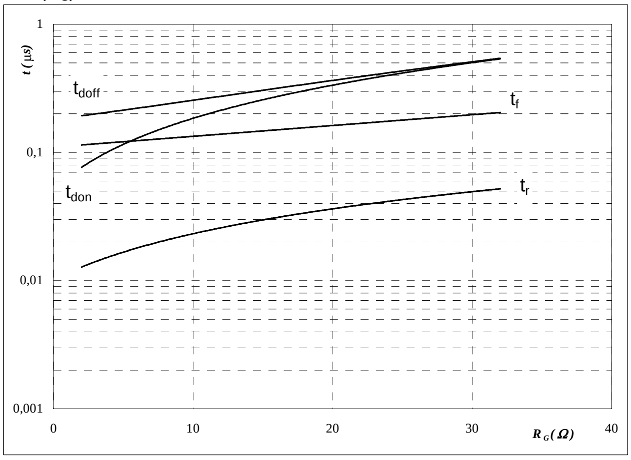
With an inductive load at

T_j =	125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

Figure 10 NP IGBT

Typical switching times as a function of gate resistor

t = f(R_G)



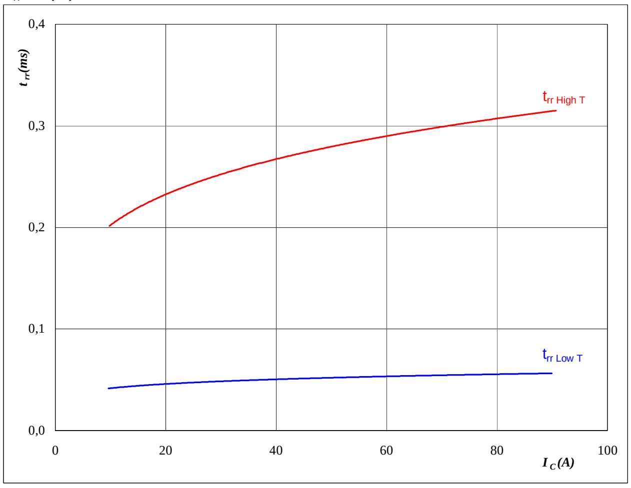
With an inductive load at

T_j =	125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	50	A

Figure 11 FWD

Typical reverse recovery time as a function of collector current

t_{rr} = f(Ic)



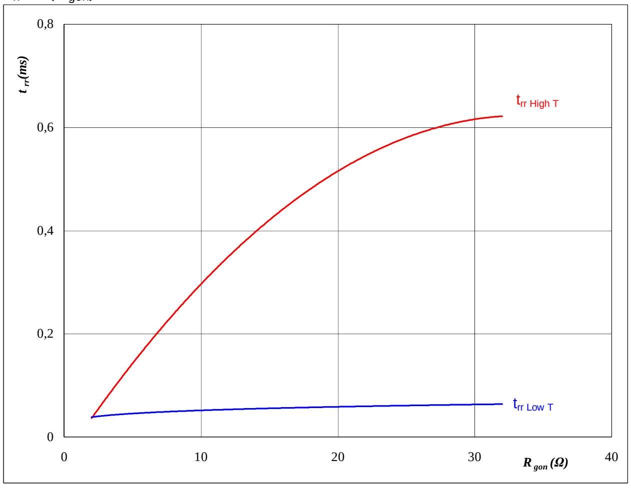
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8,0	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 =	50	A
V_{GE} =	±15	V

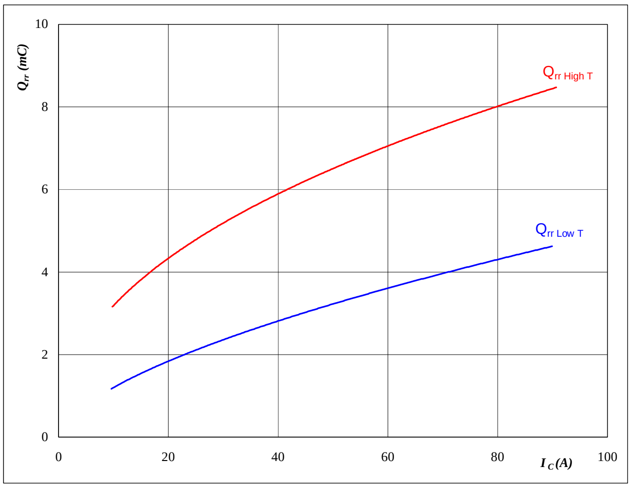
NP IGBT

neutral point IGBT and half bridge FWD

Figure 13 FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



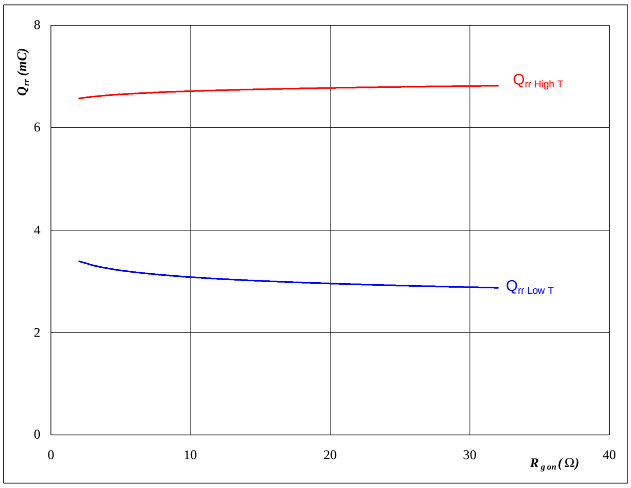
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8,0	Ω

Figure 14 FWD

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

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



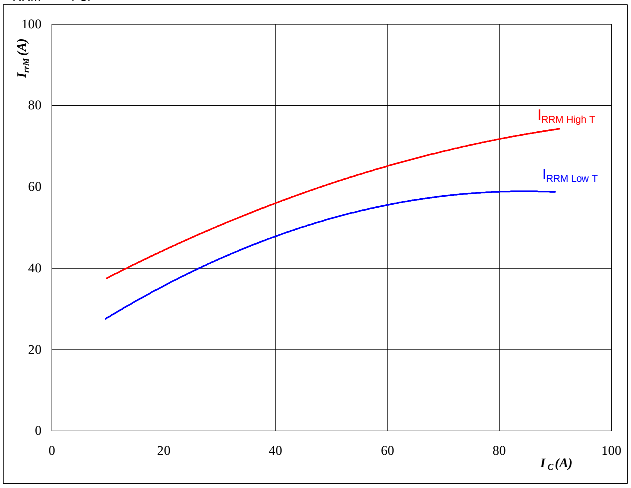
At

T_j =	25/125	°C
V_R =	350	V
I_F =	50	A
V_{GE} =	±15	V

Figure 15 FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



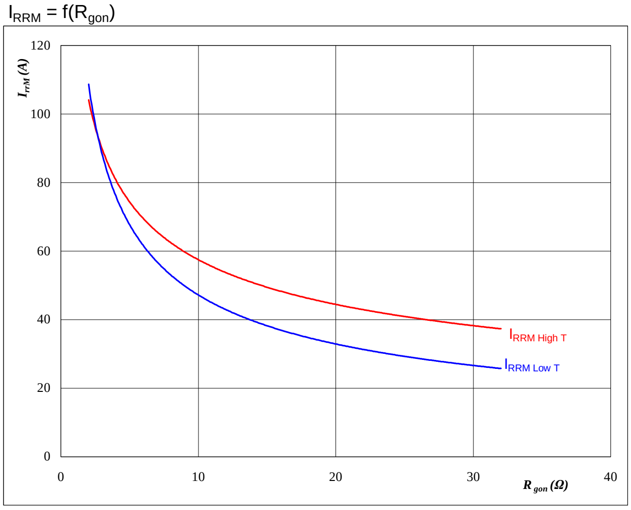
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8,0	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 =	50	A
V_{GE} =	±15	V

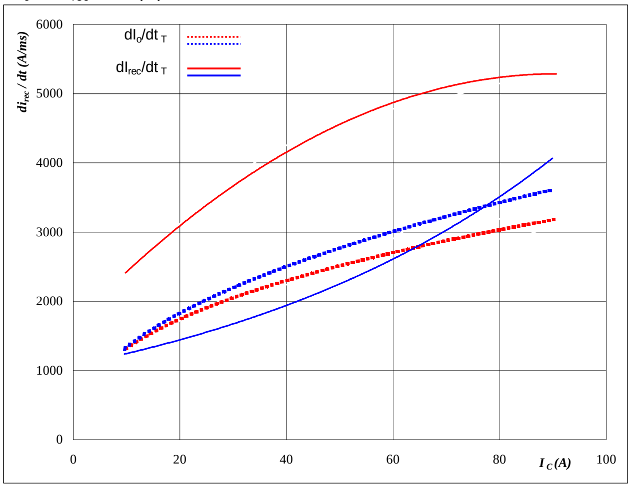
NP IGBT

neutral point IGBT and half bridge FWD

Figure 17 FWD

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

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



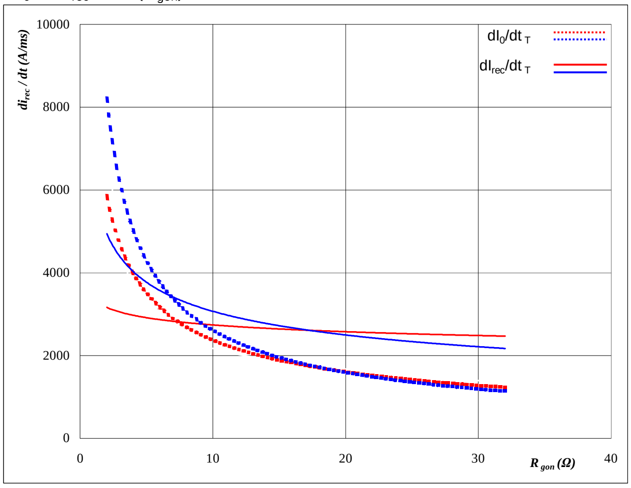
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	8,0	Ω

Figure 18 FWD

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

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



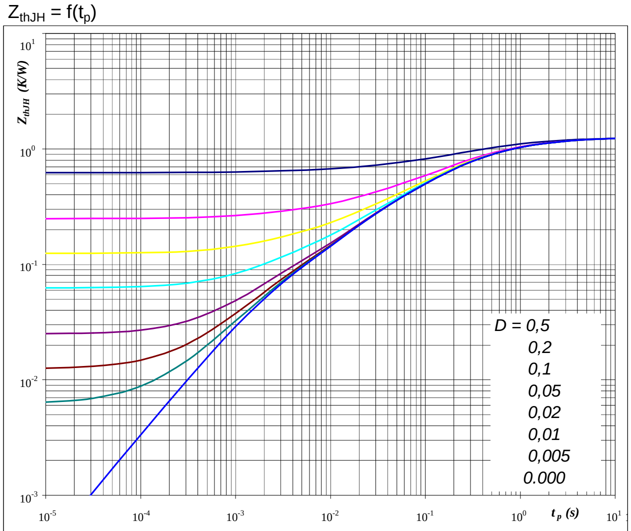
At

T_j =	25/125	°C
V_R =	350	V
I_F =	50	A
V_{GE} =	±15	V

Figure 19 NP IGBT

IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	tp / T	
R_{thJH} =	1,25	K/W

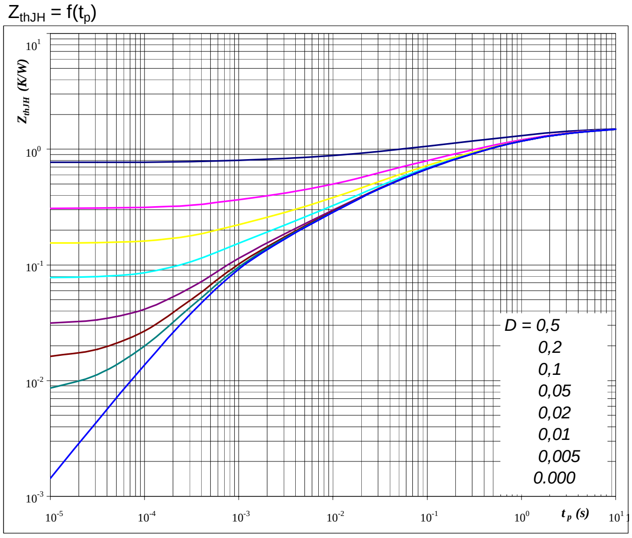
IGBT thermal model values

R (C/W)	Tau (s)
0,13	4,53
0,28	1,03
0,48	0,25
0,20	0,07
0,13	0,02

Figure 20 FWD

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

D =	tp / T	
R_{thJH} =	1,54	K/W

FWD thermal model values

R (C/W)	Tau (s)
0,20	7,23
0,36	1,40
0,33	0,34
0,28	0,08
0,20	0,02

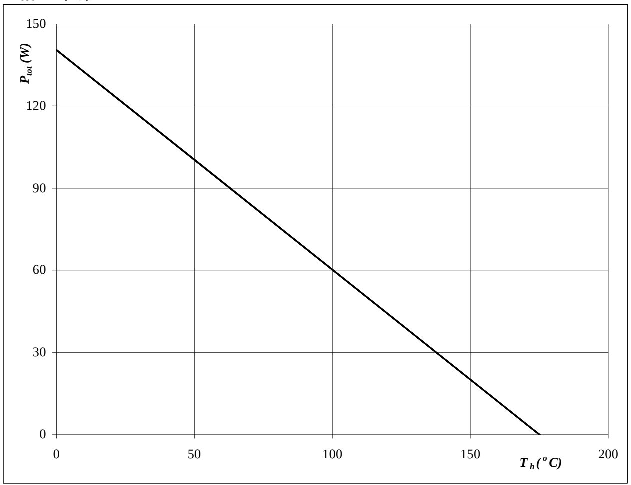
NP IGBT

neutral point IGBT and half bridge FWD

Figure 21 NP IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



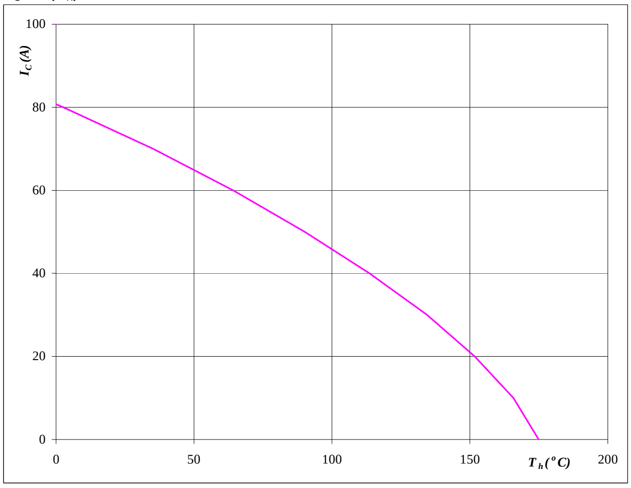
At

T_j =	175	ºC

Figure 22 NP IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_h)$



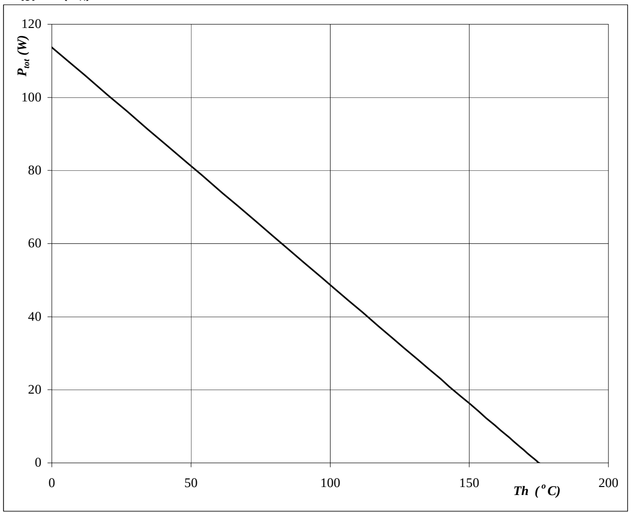
At

T_j =	175	ºC
V_{GE} =	15	V

Figure 23 FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



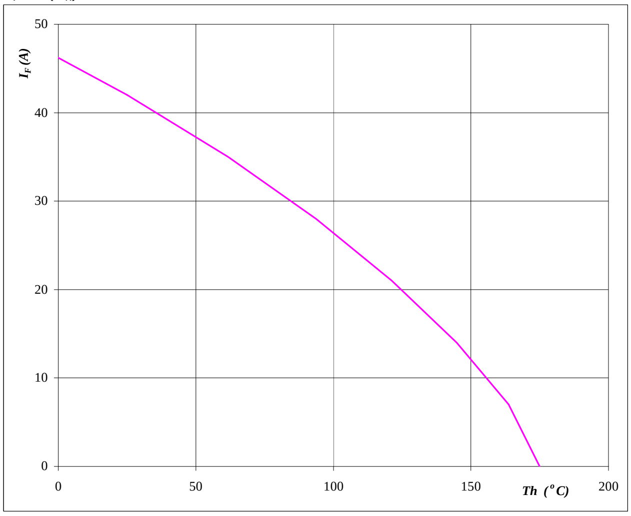
At

T_j =	175	ºC

Figure 24 FWD

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

T_j =	175	ºC

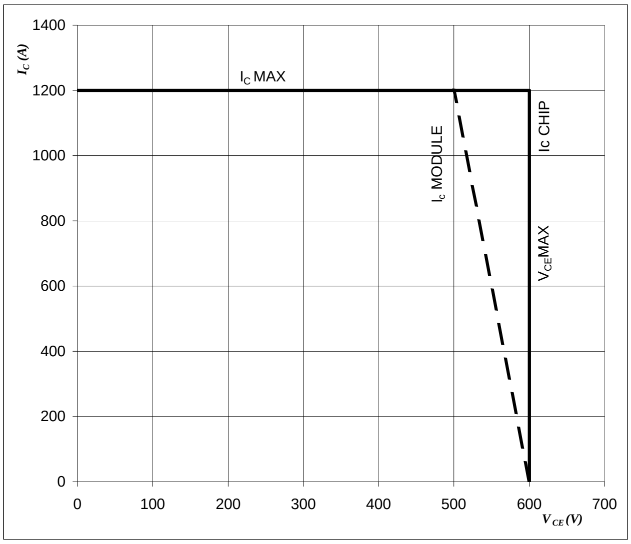
NP IGBT

neutral point IGBT

Figure 25 NP IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j = T_{jmax}-25 ºC

$U_{ccminus}$=U_{ccplus}

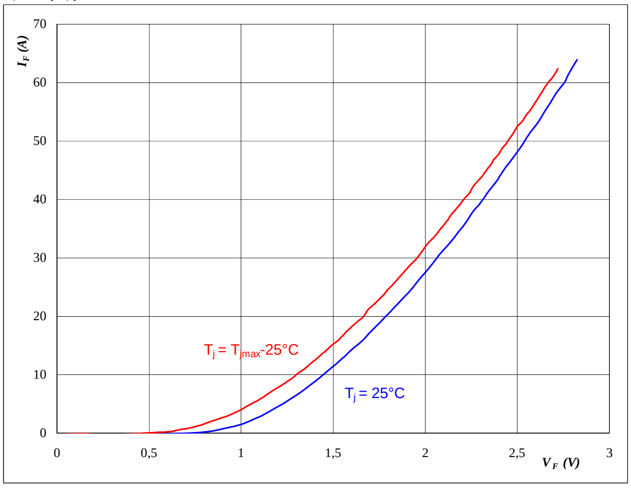
Switching mode : 3 level switching

NP IGBT Inverse Diode

Figure 25 NP Inverse Diode

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



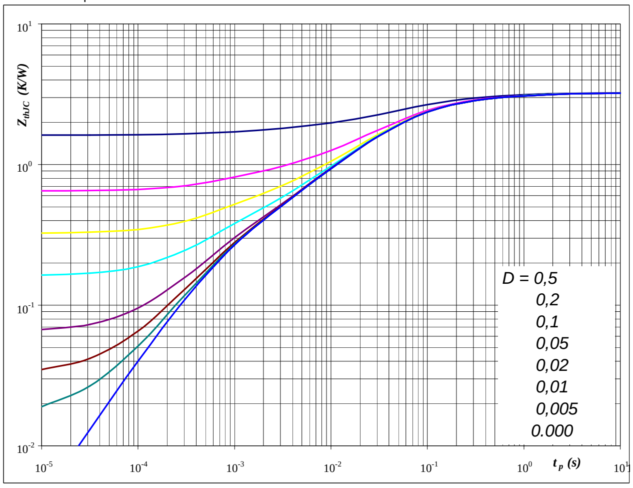
At

t_p = 250 µs

Figure 26 NP Inverse Diode

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

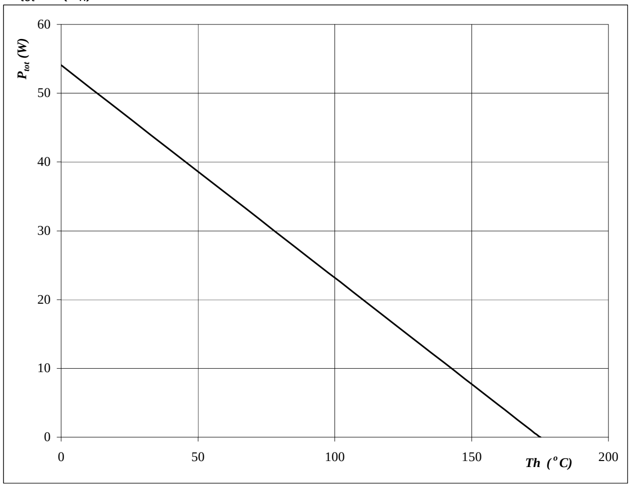
D = tp / T

R_{thJH} = 3,24 K/W

Figure 27 NP Inverse Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



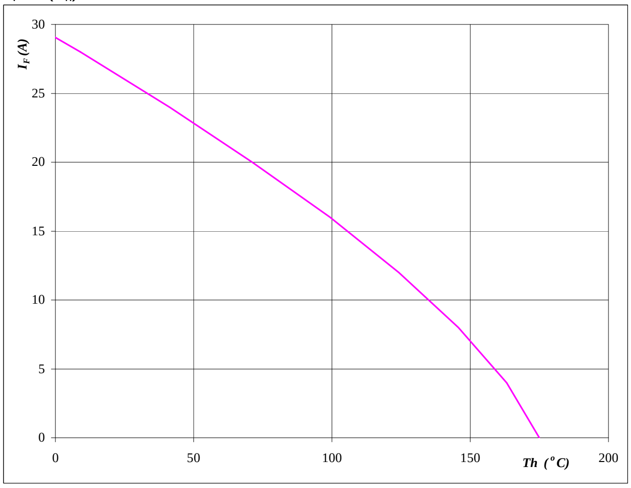
At

T_j = 175 ºC

Figure 28 NP Inverse Diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



At

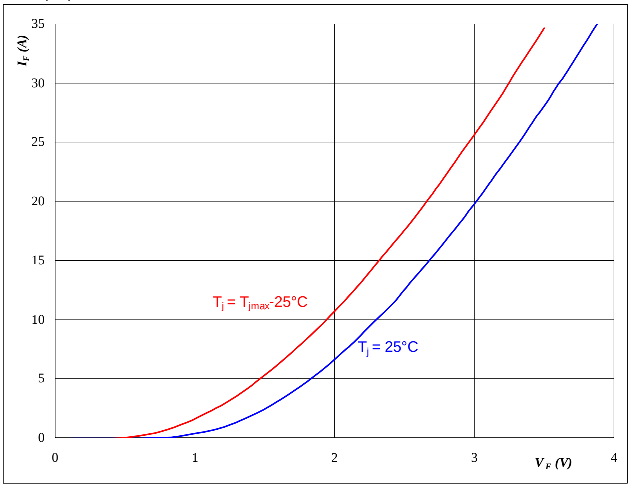
T_j = 175 ºC

Half bridge Inverse Diode

Figure 1 Halfbridge JFET Inverse Diode

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



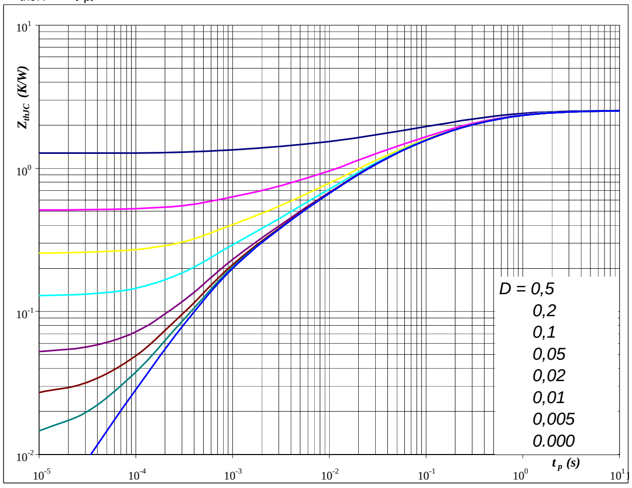
At

t_p = 250 µs

Figure 2 Halfbridge JFET Inverse Diode

FWD transient thermal impedance as a function of pulse width

$Z_{thJH} = f(t_p)$



At

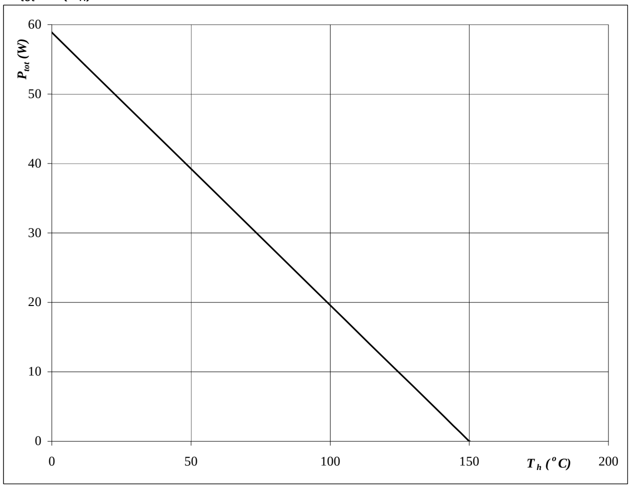
D = t_p / T

R_{thJH} = 2,548 K/W

Figure 3 Halfbridge JFET Inverse Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_h)$



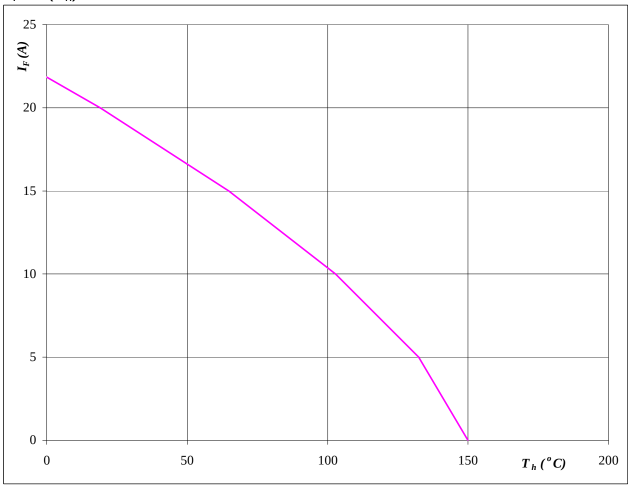
At

T_j = 150 ºC

Figure 4 Halfbridge JFET Inverse Diode

Forward current as a function of heatsink temperature

$I_F = f(T_h)$



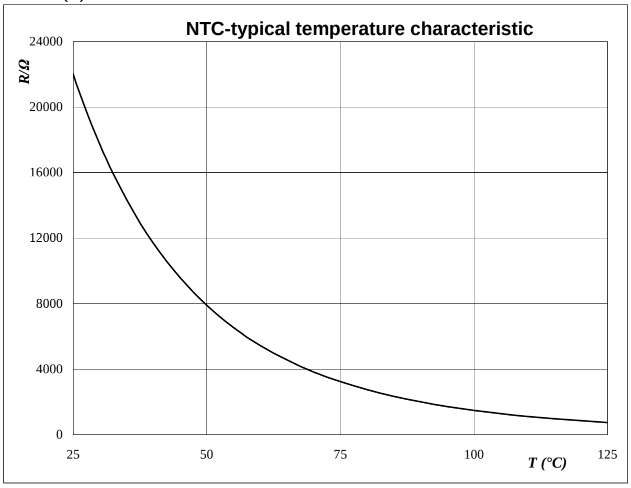
At

T_j = 150 ºC

Thermistor

Figure 1	Thermistor

Typical NTC characteristic
as a function of temperature
$R_T = f(T)$



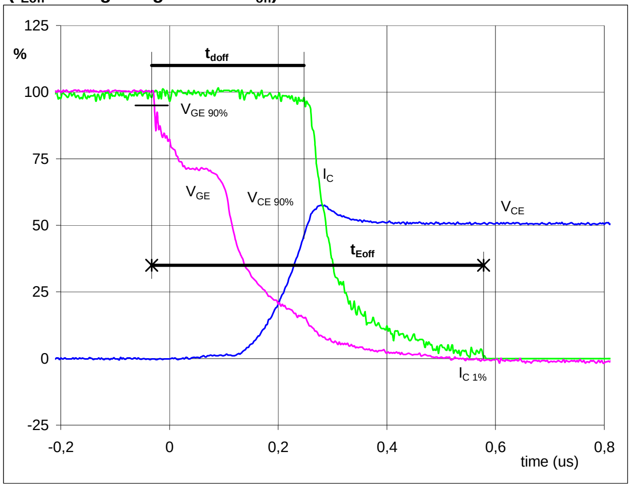
Switching Definitions half bridge IGBT

General conditions

T_j	=	125 °C
R_{gon}	=	8 Ω
R_{goff}	=	8 Ω

Figure 1 half bridge IGBT

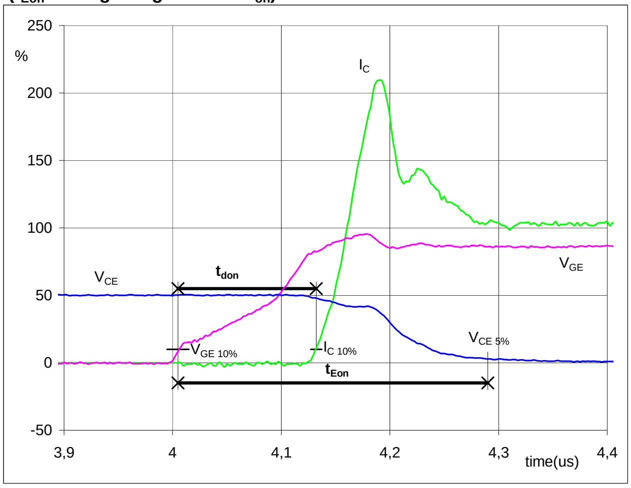
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	50	A
t_{doff} =	0,27	µs
t_{Eoff} =	0,61	µs

Figure 2 half bridge IGBT

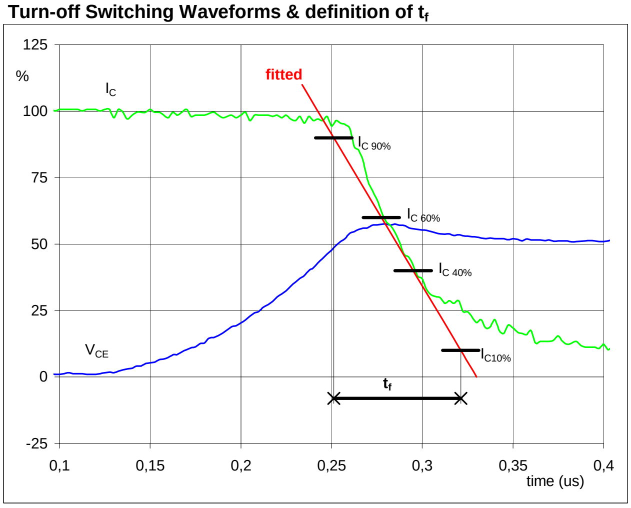
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	50	A
t_{don} =	0,13	µs
t_{Eon} =	0,28	µs

Figure 3 half bridge IGBT

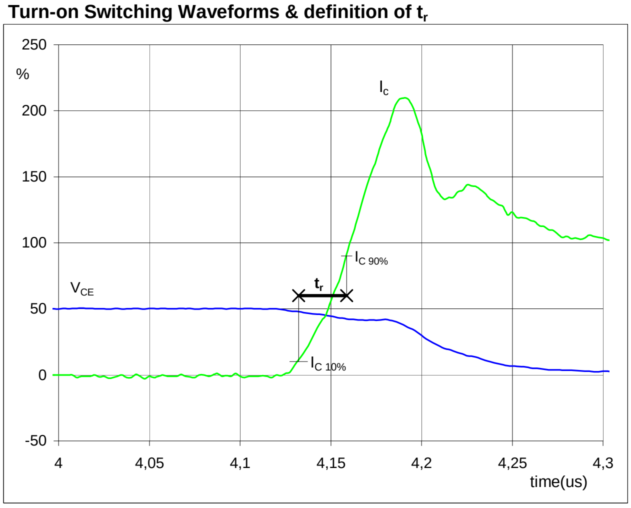
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	700	V
I_C (100%) =	50	A
t_f =	0,07	µs

Figure 4 half bridge IGBT

Turn-on Switching Waveforms & definition of t_r

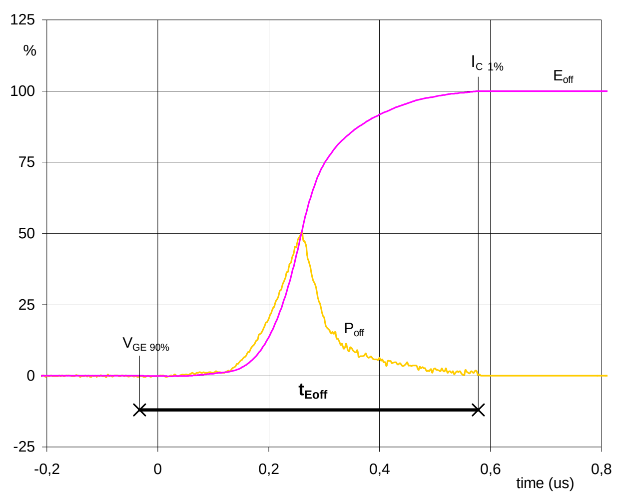


V_C (100%) =	700	V
I_C (100%) =	50	A
t_r =	0,03	µs

Switching Definitions half bridge IGBT

Figure 5 half bridge IGBT

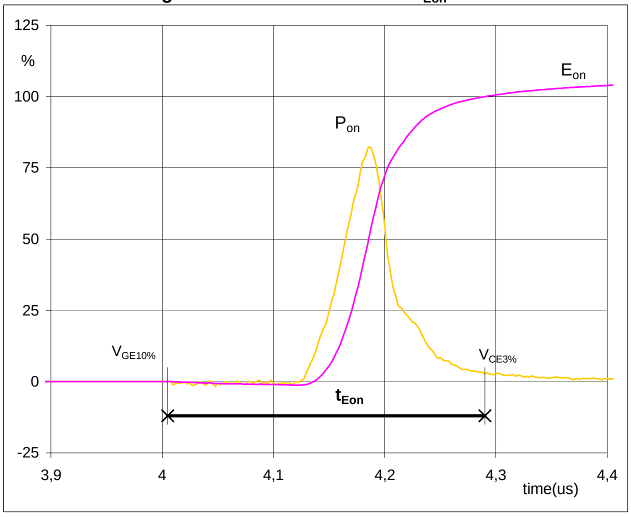
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	35,18	kW
E_{off} (100%) =	2,00	mJ
t_{Eoff} =	0,61	μs

Figure 6 half bridge IGBT

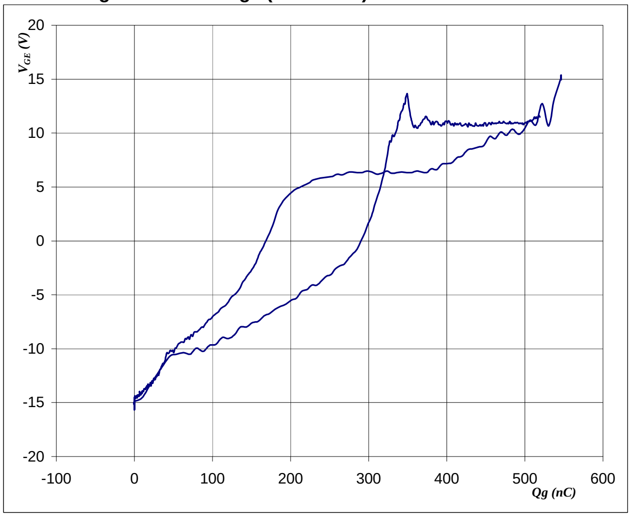
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	35,18	kW
E_{on} (100%) =	1,64	mJ
t_{Eon} =	0,28	μs

Figure 7 half bridge IGBT

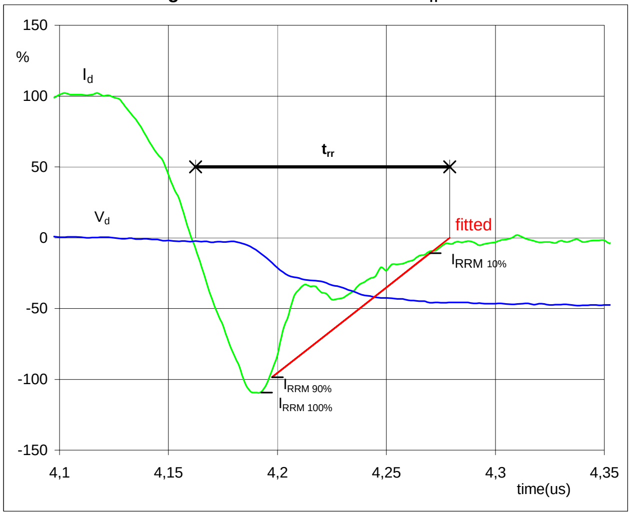
Gate voltage vs Gate charge (measured)



V_{GEoff} =	-15	V
V_{GEon} =	15	V
V_C (100%) =	700	V
I_C (100%) =	50	A
Q_g =	546,28	nC

Figure 8 neutral point FWD

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

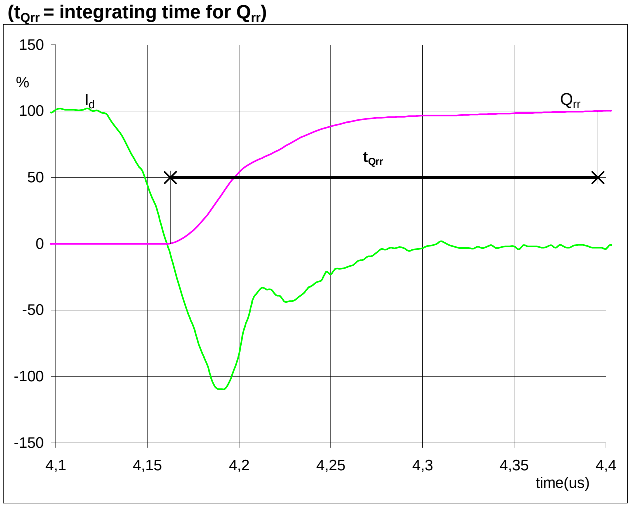


V_d (100%) =	700	V
I_d (100%) =	50	A
I_{RRM} (100%) =	-56	A
t_{rr} =	0,12	μs

Switching Definitions half bridge FWD

Figure 9 neutral point FWD

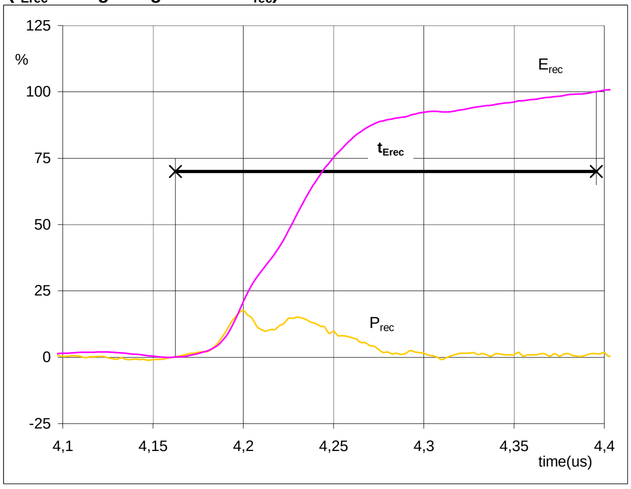
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	50	A
Q_{rr} (100%) =	2,73	µC
t_{Qrr} =	0,23	µs

Figure 10 neutral point FWD

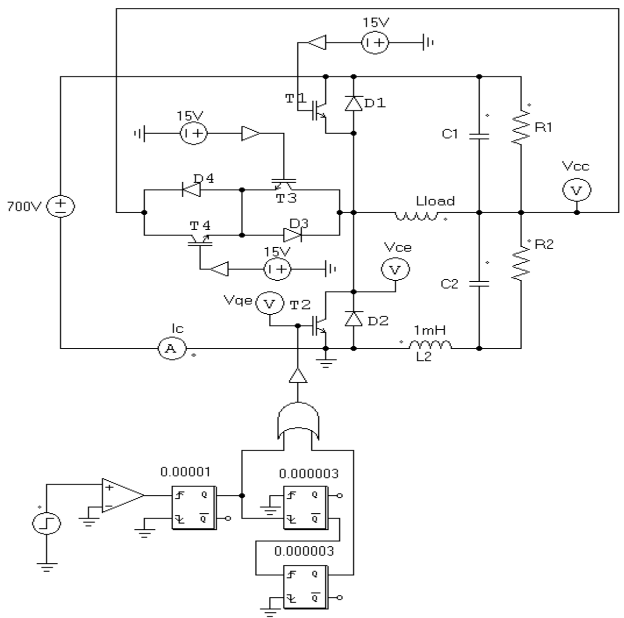
Turn-on Switching Waveforms & definition of t_{Erec}
(t_{Erec}= integrating time for E_{rec})



P_{rec} (100%) =	35,18	kW
E_{rec} (100%) =	0,41	mJ
t_{Erec} =	0,23	µs

half bridge switching measurement circuit

Figure 111 half bridge IGBT



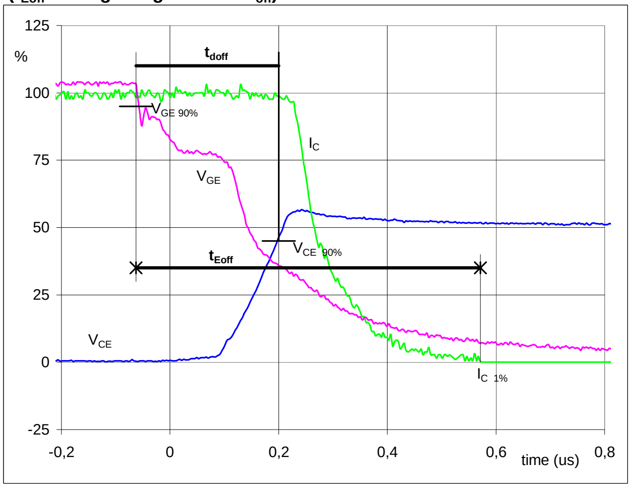
Switching Definitions neutral point IGBT

General conditions

T_j	=	125 °C
R_{gon}	=	8 Ω
R_{goff}	=	8 Ω

Figure 1 neutral point IGBT

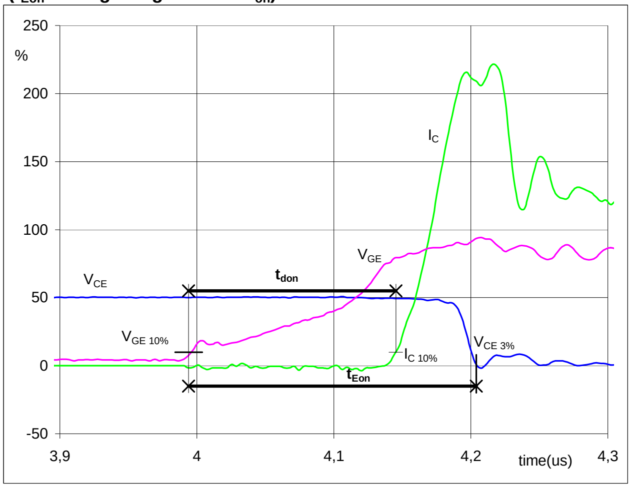
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
(t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	50	A
t_{doff} =	0,10	μs
t_{Eoff} =	0,17	μs

Figure 2 neutral point IGBT

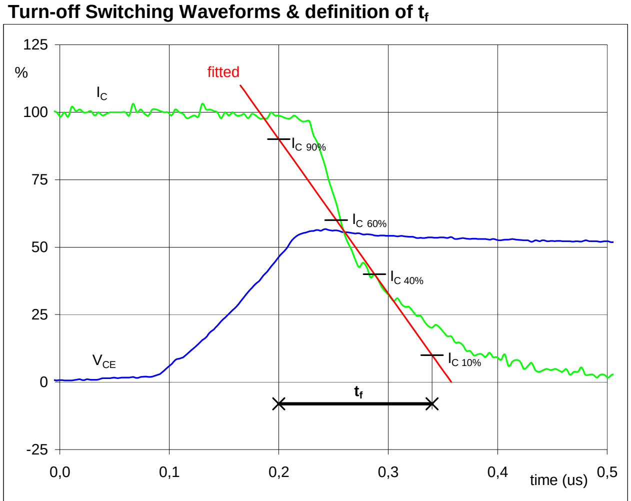
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
(t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	50	A
t_{don} =	0,15	μs
t_{Eon} =	0,12	μs

Figure 3 neutral point IGBT

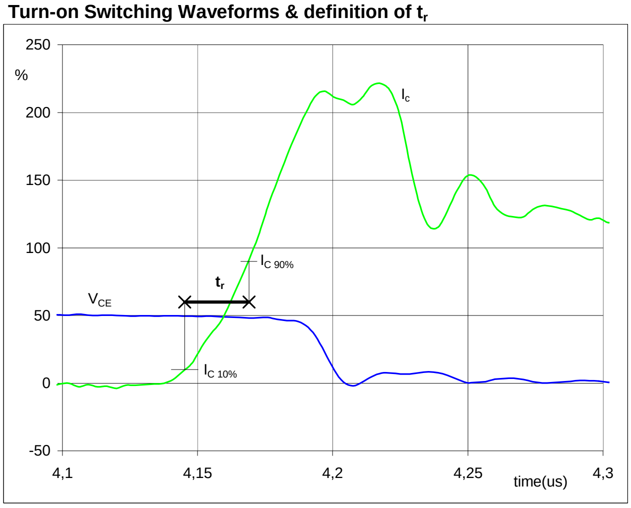
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	700	V
I_C (100%) =	50	A
t_f =	0,119	μs

Figure 4 neutral point IGBT

Turn-on Switching Waveforms & definition of t_r

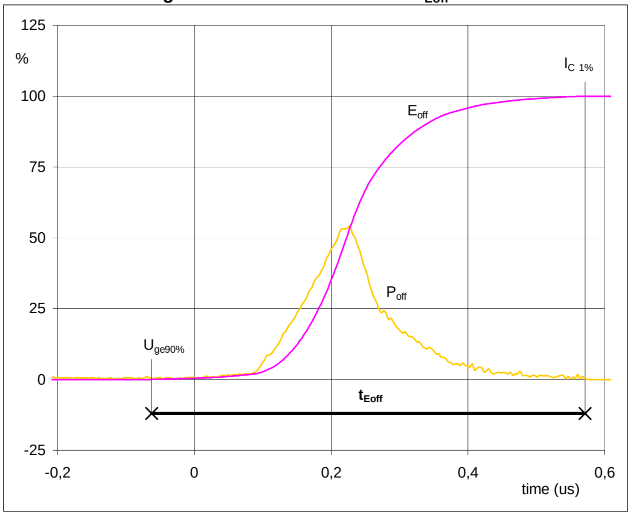


V_C (100%) =	700	V
I_C (100%) =	50	A
t_r =	0,024	μs

Switching Definitions neutral point IGBT

Figure 5 neutral point IGBT

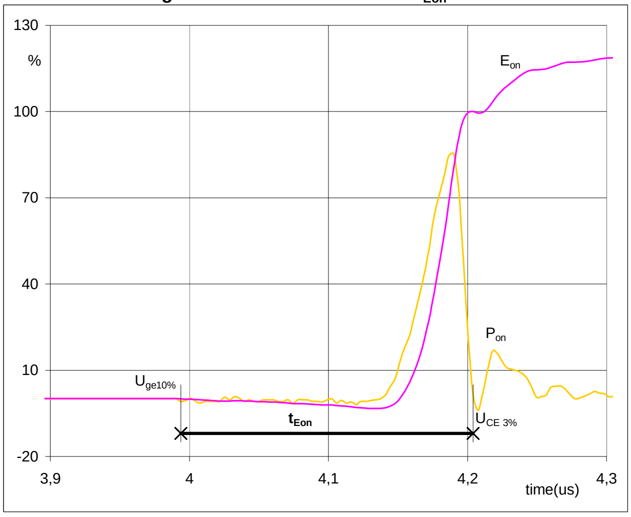
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	34,87	kW
E_{off} (100%) =	2,32	mJ
t_{Eoff} =	0,17	μs

Figure 6 neutral point IGBT

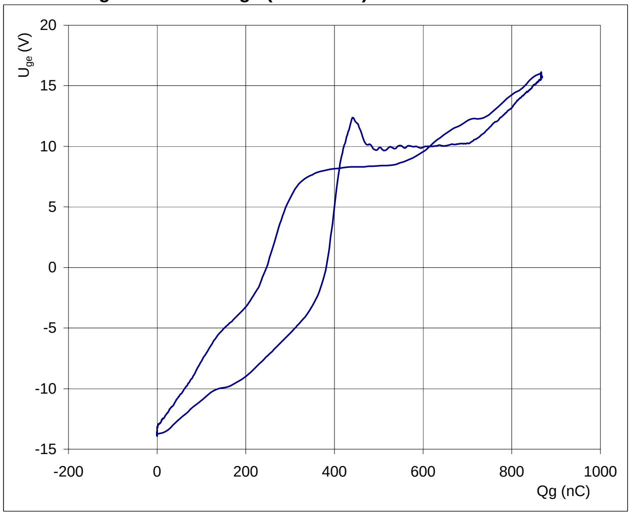
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	34,8684	kW
E_{on} (100%) =	0,38	mJ
t_{Eon} =	0,12	μs

Figure 7 neutral point IGBT

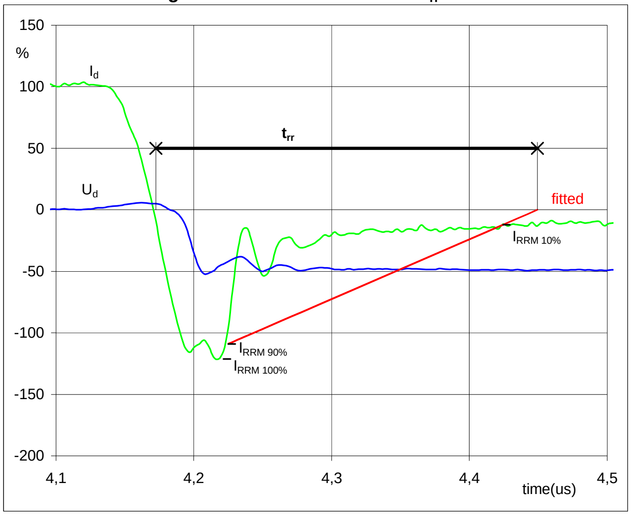
Gate voltage vs Gate charge (measured)



V_{GEoff} =	-15	V
V_{GEon} =	15	V
V_C (100%) =	700	V
I_C (100%) =	50	A
Q_g =	3441,54	nC

Figure 8 half bridge FWD

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

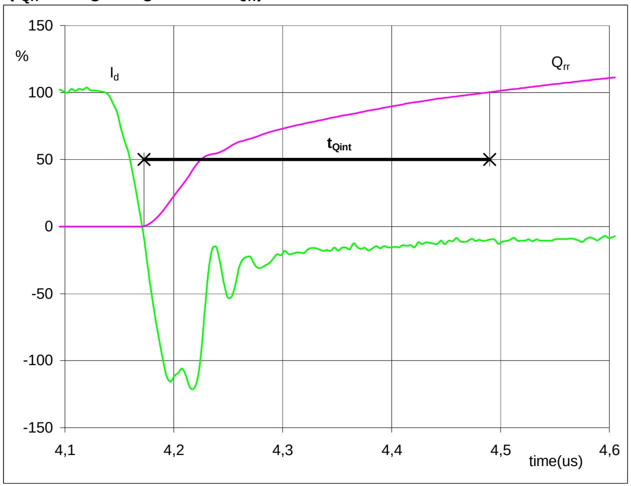


V_d (100%) =	700	V
I_d (100%) =	50	A
I_{RRM} (100%) =	-61	A
t_{rr} =	0,04	μs

Switching Definitions neutral point IGBT

Figure 9 half bridge FWD

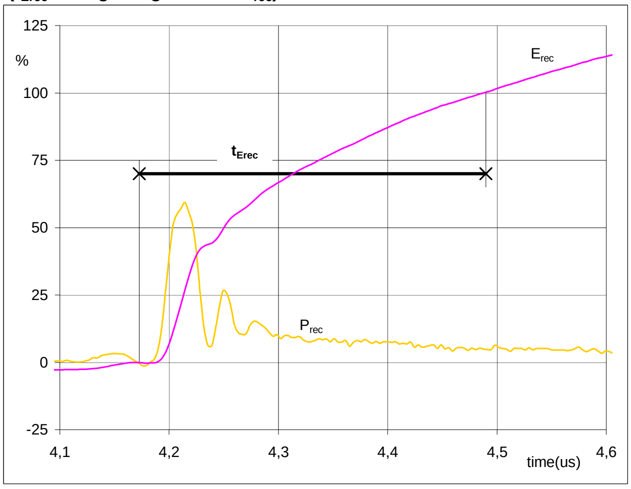
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr}= integrating time for Q_{rr})



I_d (100%) =	50	A
Q_{rr} (100%) =	6,56	μC
t_{Qint} =	0,09	μs

Figure 10 half bridge FWD

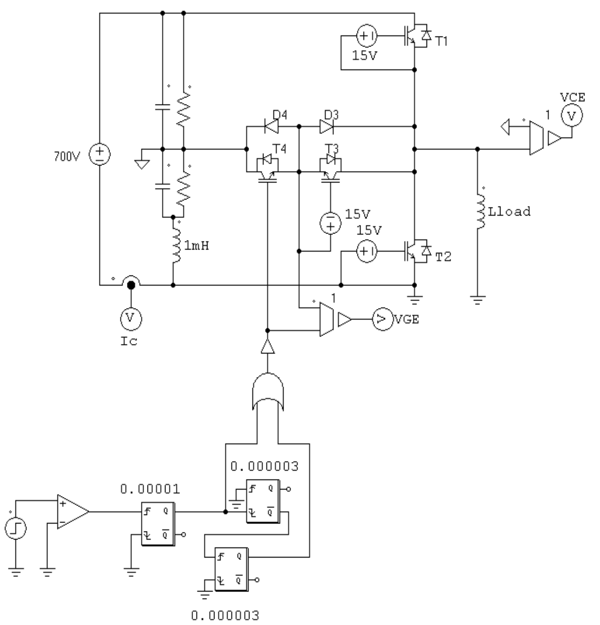
Turn-on Switching Waveforms & definition of t_{Erec}
(t_{Erec}= integrating time for E_{rec})



P_{rec} (100%) =	34,87	kW
E_{rec} (100%) =	1,72	mJ
t_{Erec} =	0,09	μs

neutral point IGBT switching measurement circuit

Figure 11



Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 12mm housing	10-FY12NMA080SH-M427F	M427F	M427F
without thermal paste 12mm housing with pressfit pin	10-PY12NMA080SH-M427FY	M427FY	M427FY

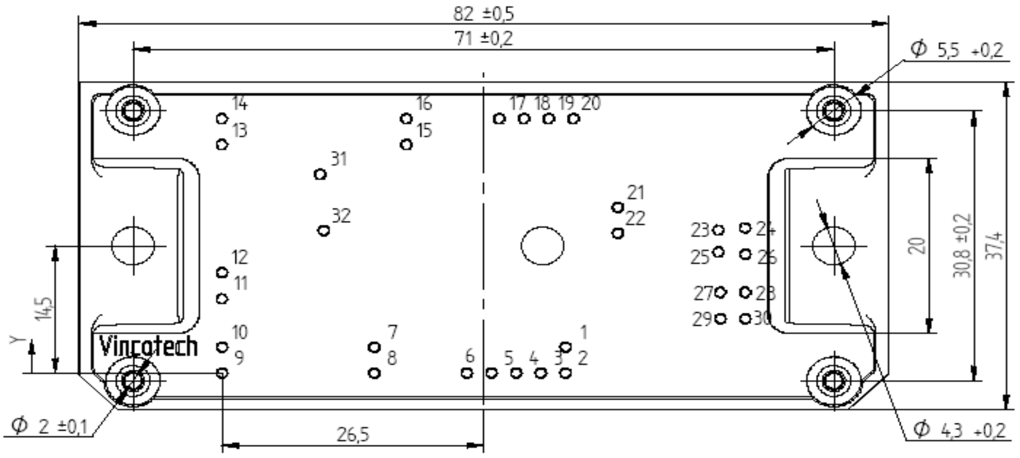
Outline

Pin table

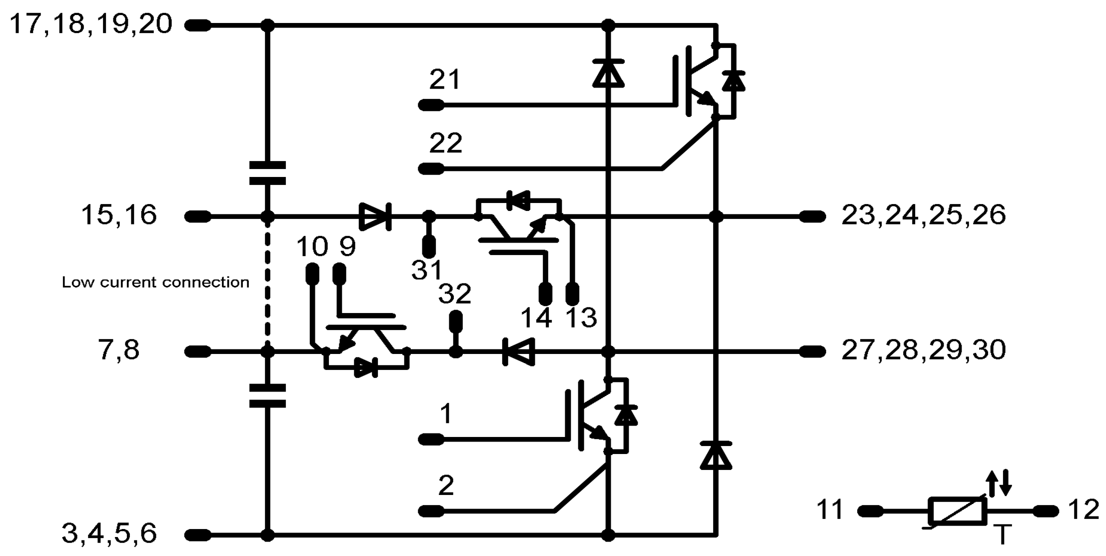
Pin	X	Y
1	34,8	2,95
2	34,8	0
3	32,3	0
4	29,8	0
5	27,3	0
6	24,8	0
7	15,45	2,95
8	15,45	0
9	0	0
10	0	2,95
11	0	8,45
12	0	11,45
13	0	26,05
14	0	29
15	18,7	26,05
16	18,7	29
17	28,1	29
18	30,6	29
19	33,1	29
20	35,6	29
21	40,1	18,9
22	40,1	15,95
23	50,3	16,3
24	53	16,55
25	50,3	13,8
26	53	13,55
27	50,5	9,2
28	53	9,2

Pin table

Pin	X	Y
29	50,5	6,2
30	53	6,2
31	9,95	22,65
32	10,3	16,25



Pinout



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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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