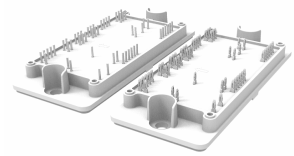
***flow* 2 MNPC** — **1200 V / 200 A**

Features

- Mixed voltage NPC topology
- Reactive power capability
- Low inductance layout
- High speed IGBT and split output
- Common collector neutral connection

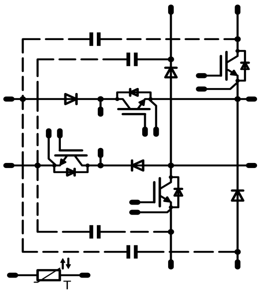
flow 2 13mm housing



Target Applications

- Solar inverter
- UPS
- Active frontend

Schematic



Types

- 30-FT12NMA200SH-M660F08
- 30-PT12NMA200SH-M660F08Y

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Half Bridge Sw. Protection Diode					
Repetitive peak reverse voltage	V_{RRM}			1200	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	25	A
Maximum repetitive forward current	I_{FRM}	t_p = 10 ms		30	A
Power dissipation	P_{tot}		T_s = 80 °C	52	W
Maximum Junction Temperature	T_{jmax}			150	°C
Half Bridge Switch					
Collector-emitter breakdown voltage	V_{CE}			1200	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	171	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		600	A
Turn off safe operation area		V_{CE}max = 1200V, T_{vj} ≤ 150°C		400	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	434	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V		10 800	μs V
Maximum Junction Temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Neutral Point FWD					
Peak Repetitive Reverse Voltage	V_{RRM}			700	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	87	A
Diode maximum forward current	I_{FRM}	t_p limited by T_{jmax}		300	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	109	W
Maximum Junction Temperature	T_{jmax}			150	°C
Neutral Point Switch					
Collector-emitter breakdown voltage	V_{CE}			600	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	124	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		450	A
Turn off safe operation area		V_{CE} ≤ 600V, T_j ≤ 175°C		450	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	198	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V		6 360	μs V
Maximum Junction Temperature	T_{jmax}			175	°C
Neutral Point Sw. Protection Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			600	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	49	A
Maximum repetitive forward current	I_{FRM}	t_p limited by T_{jmax}		100	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	82	W
Maximum Junction Temperature	T_{jmax}			175	°C
Half Bridge FWD					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	84	A
Nonrepetitive peak surge current	I_{FSM}	t_p limited by T_{jmax}		540	A
Power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	186	W
Maximum Junction Temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

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

Characteristic Values

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	Unit
Half Bridge Sw. Protection Diode										
Forward voltage	V_F				15	25 125	1,6	2,12 1,74	2,6	V
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness ≤ 50um λ = 1 W/mK						1,35		K/W
Half Bridge Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0068	25	5,2	5,8	6,4	V
Collector-emitter saturation voltage	V_{CEsat}		15		200	25 125	2	2,17 2,58	2,4	V
Collector-emitter cut-off current incl. Diode	I_{CES}		0	1200		25			24	µA
Gate-emitter leakage current	I_{GES}		20	0		25			480	nA
Integrated Gate resistor	R_{gint}							1		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff} = 2 Ω R_{gon} = 2 Ω	±15	350	200	25 125		124 126		ns
Rise time	t_r					25 125		27 32		
Turn-off delay time	$t_{d(off)}$					25 125		190 234		
Fall time	t_f					25 125		41 61		
Turn-on energy loss	E_{on}					25 125		2,38 4,20		mWs
Turn-off energy loss	E_{off}					25 125		5,02 7,97		
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		11080		pF
Output capacitance	C_{oss}							1150		
Reverse transfer capacitance	C_{rss}							640		
Gate charge	Q_G		15	960	160			960		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness ≤ 50um λ = 1 W/mK						0,22		K/W

*additional value stands for built-in capacitor

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	Unit
Neutral Point FWD										
Diode forward voltage	V_F				150	25 125	1,4	1,80 1,61	3,3	V
Peak reverse recovery current	I_{RRM}	R_{gon} = 2 Ω	±15	350	200	25 125		130 169		A
Reverse recovery time	t_{rr}					25 125		93 118		ns
Reverse recovered charge	Q_{rr}					25 125		4,47 11,00		µC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		5241 1766		A/µs
Reverse recovered energy	E_{rec}					25 125		0,91 2,39		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness ≤ 50um λ = 1 W/mK						0,64		K/W

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_r [V] V_{CE} [V] V_{DS} [V]	I_C [A] I_F [A] I_D [A]	T_j [°C]	Min	Typ	Max	
Neutral Point Switch										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0024	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		150	25 125	1,05	1,57 1,68	1,85	V
Collector-emitter cut-off incl diode	I_{CES}		0	600		25			7,6	µA
Gate-emitter leakage current	I_{GES}		20	0		25			1200	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff} = 2 Ω R_{gon} = 2 Ω	±15	350	150	25 125		123 114		ns
Rise time	t_r					25 125		21 21		ns
Turn-off delay time	$t_{d(off)}$					25 125		168 177		ns
Fall time	t_f					25 125		38 59		ns
Turn-on energy loss	E_{on}					25 125		1,18 1,72		µWs
Turn-off energy loss	E_{off}					25 125		3,59 5,13		µWs
Input capacitance	C_{ies}	f = 1 MHz	15	480	150	25		9240		pF
Output capacitance	C_{oss}							576		pF
Reverse transfer capacitance	C_{rss}							274		pF
Gate charge	Q_G		15	480	150			940		nC
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness ≤ 50um λ = 1 W/mK						0,48		K/W
Neutral Point Sw. Protection Diod										
Diode forward voltage	V_F				50	25 125	1,20	1,78 1,70	1,90	V
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness ≤ 50um λ = 1 W/mK						1,16		K/W
Half Bridge FWD										
Diode forward voltage	V_F				100	25 150	1,50	2,23 2,34	2,54	V
Reverse leakage current	I_r			1200		25			120	µA
Peak reverse recovery current	I_{RRM}	R_{gon} = 2 Ω	±15	350	100	25 150		184 216		A
Reverse recovery time	t_{rr}					25 150		48 114		ns
Reverse recovered charge	Q_{rr}					25 150		6,62 12,94		µC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		11659 9489		A/µs
Reverse recovery energy	E_{rec}					25 150		1,62 3,42		mWs
Thermal resistance junction to sink	$R_{th(j-s)}$	Thermal grease thickness ≤ 50um λ = 1 W/mK						0,51		K/W
Thermistor										
Rated resistance	R					25		22000		Ω
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1486 Ω				100	-5		+5	%
Power dissipation	P					25		200		mW
Power dissipation constant						25		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				25		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				25		3998		K
Vincotech NTC Reference									B	

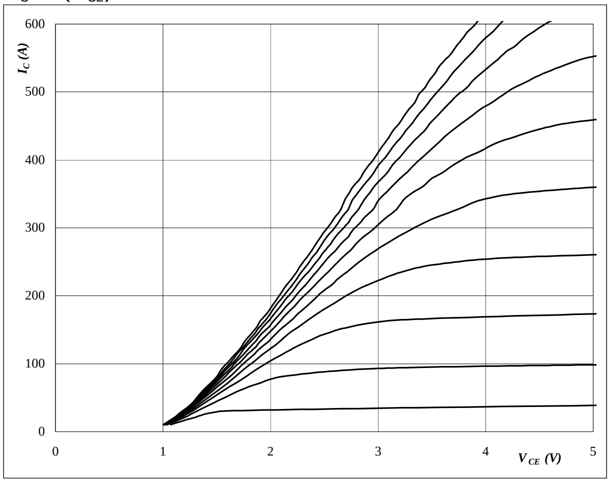
Half Bridge

Half Bridge IGBT and Neutral Point FWD

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

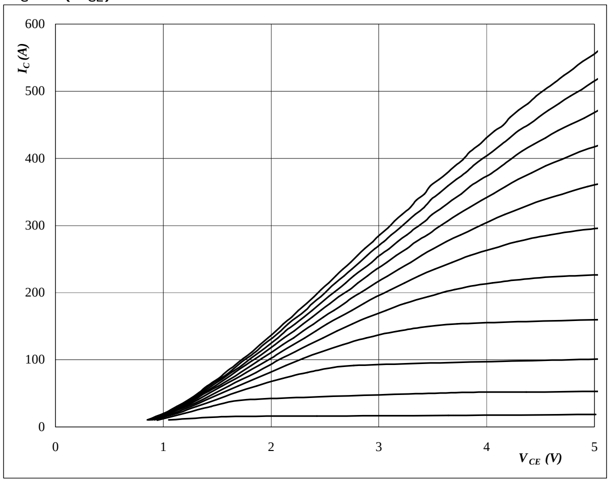
T_j = 25 °C

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

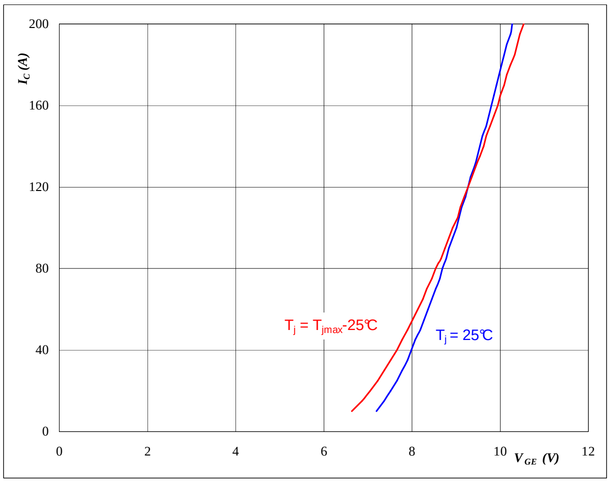
T_j = 125 °C

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

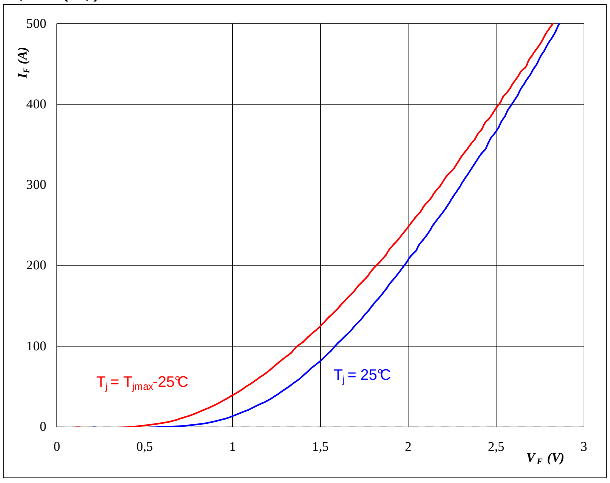
V_{CE} = 10 V

T_j = 25/150 °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 = 25/150 °C

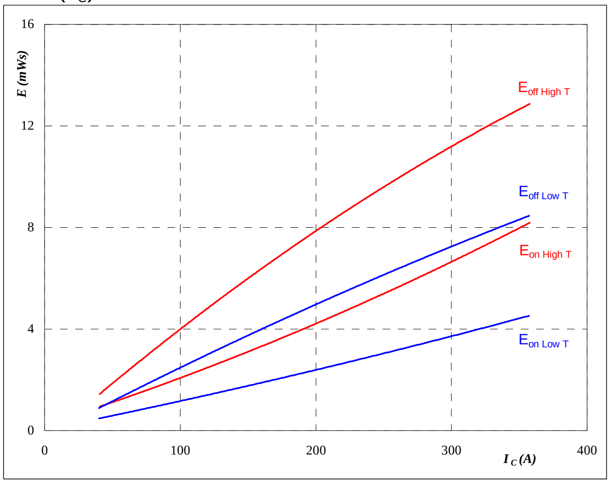
Half Bridge

Half Bridge IGBT and Neutral Point FWD

figure 5. **IGBT**

Typical switching energy losses
as a function of collector current

$E = f(I_C)$



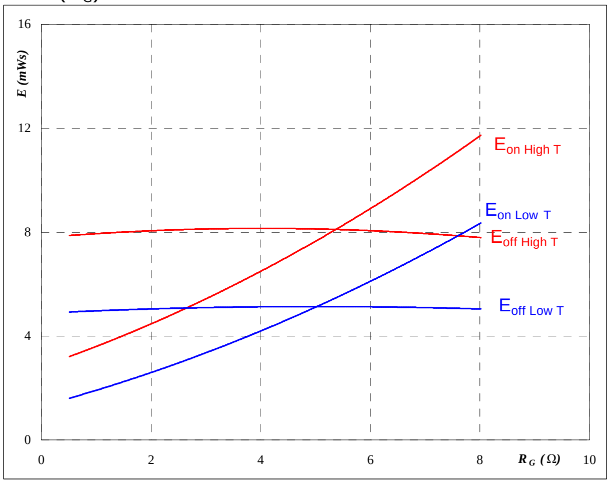
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

figure 6. **IGBT**

Typical switching energy losses
as a function of gate resistor

$E = f(R_G)$



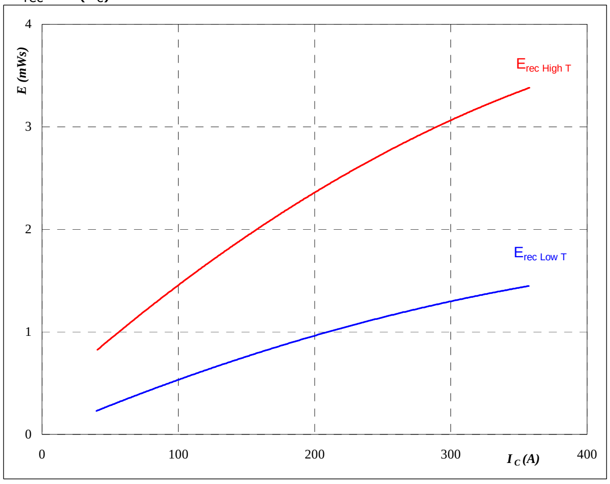
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	198	A

figure 7. **FWD**

Typical reverse recovery energy loss
as a function of collector current

$E_{rec} = f(I_c)$



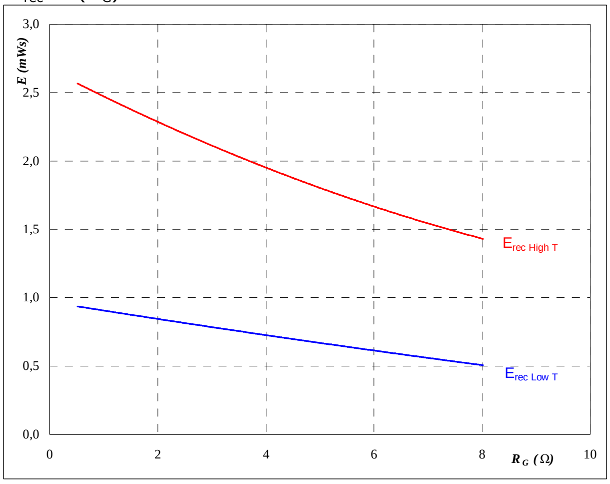
With an inductive load at

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	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 =	198	A

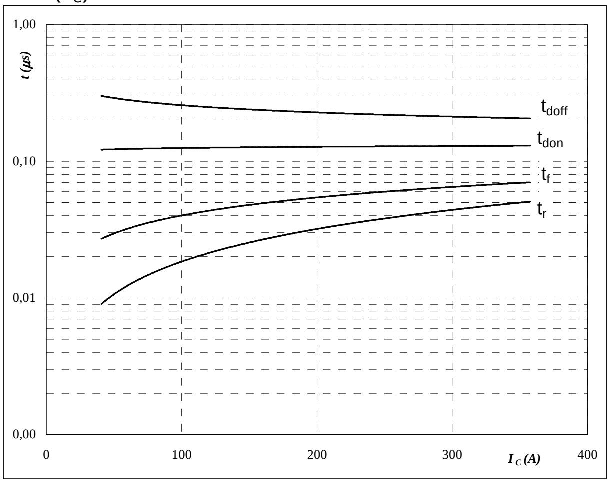
Half Bridge

Half Bridge IGBT and Neutral Point FWD

figure 9. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



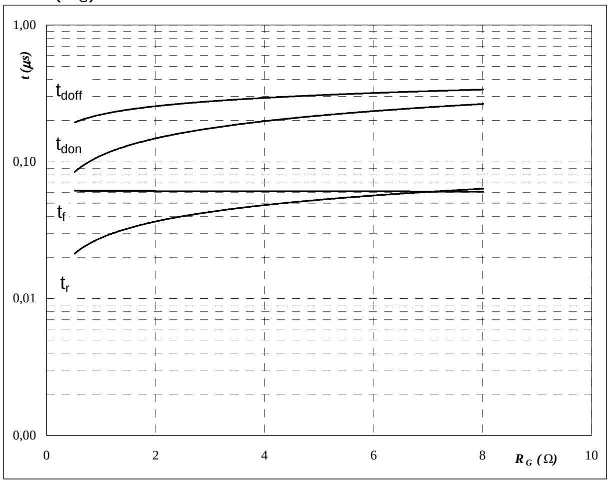
With an inductive load at

T_j =	125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

figure 10. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_G)$



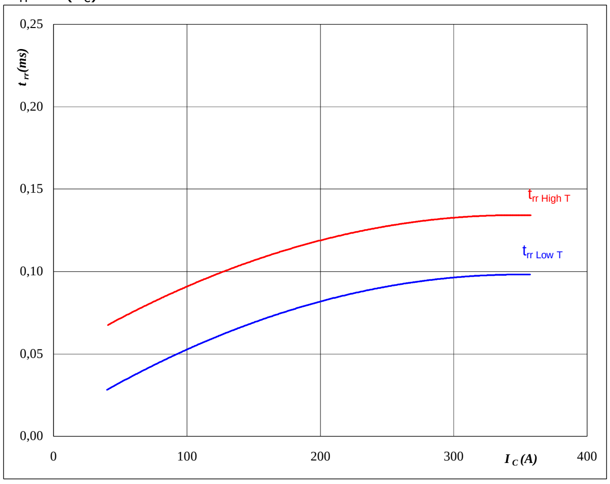
With an inductive load at

T_j =	125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	198	A

figure 11. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$



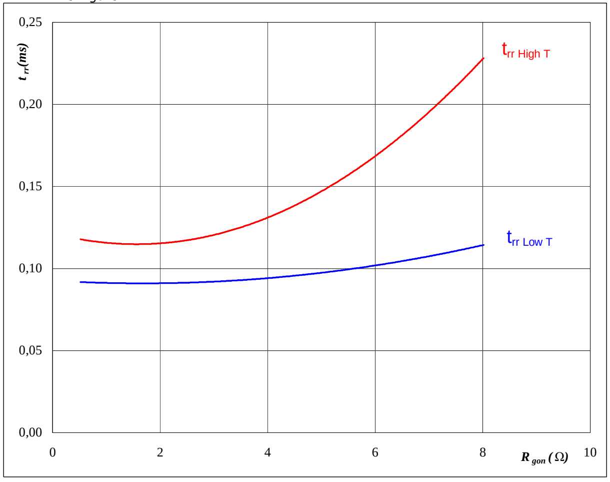
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	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 =	198	A
V_{GE} =	±15	V

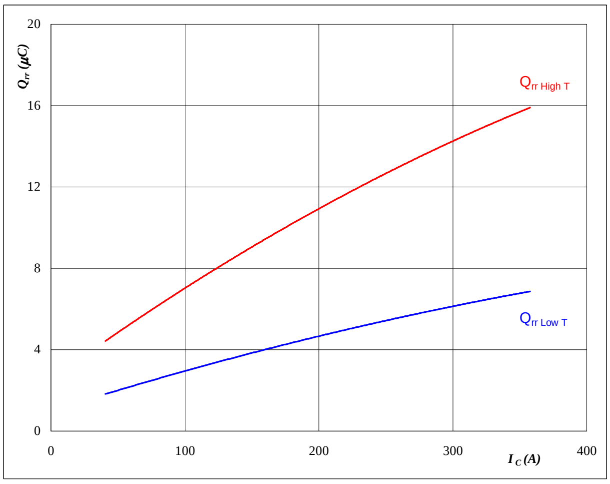
Half Bridge

Half Bridge IGBT and Neutral Point FWD

figure 13. **FWD**

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



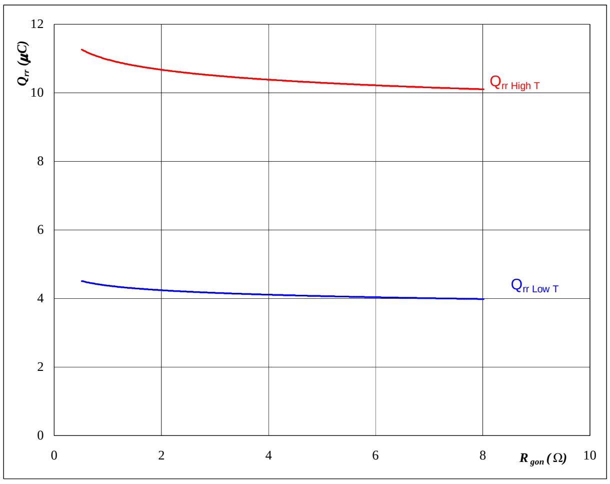
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

figure 14. **FWD**

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

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



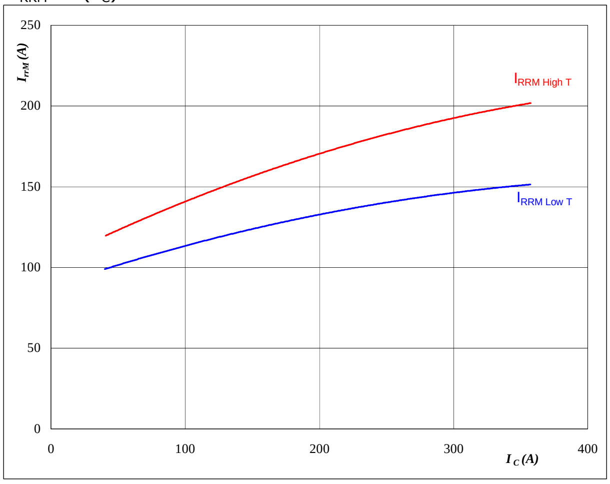
At

T_j =	25/125	°C
V_R =	350	V
I_F =	198	A
V_{GE} =	±15	V

figure 15. **FWD**

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



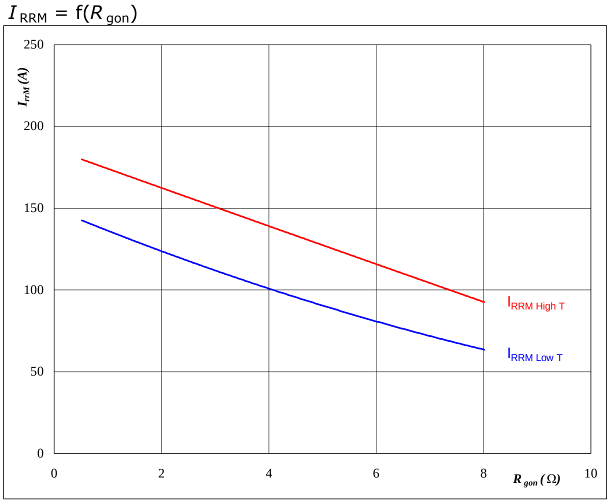
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	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 =	198	A
V_{GE} =	±15	V

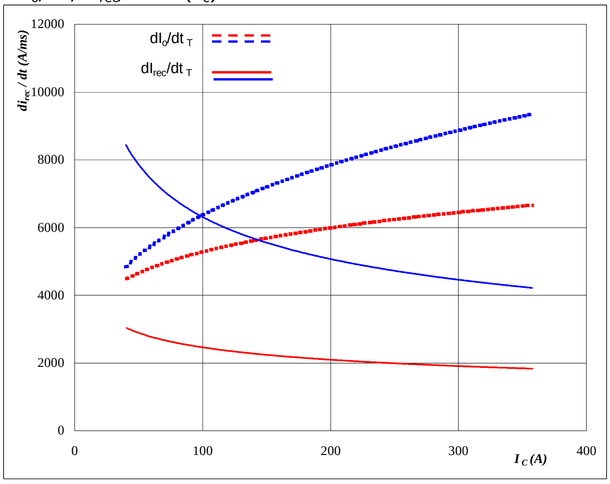
Half Bridge

Half Bridge IGBT and Neutral Point FWD

figure 17. **FWD**

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

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



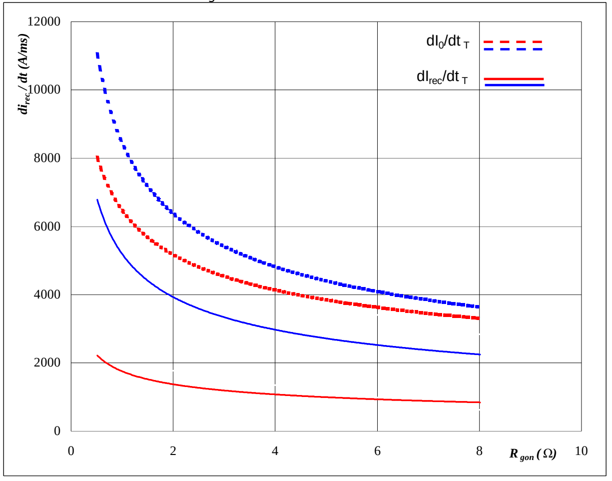
At

T_j =	25/125	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

figure 18. **FWD**

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

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



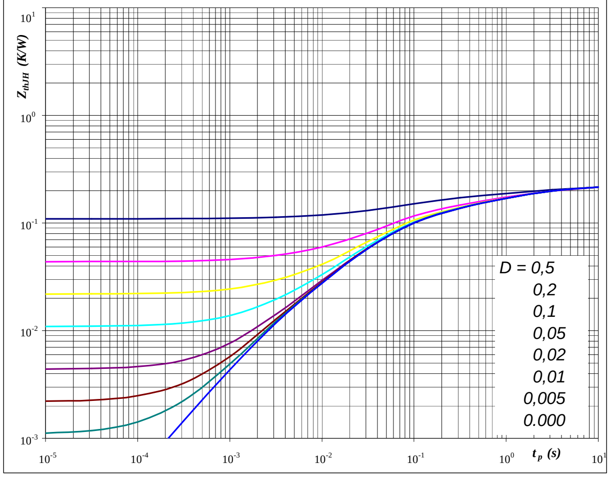
At

T_j =	25/125	°C
V_R =	350	V
I_F =	198	A
V_{GE} =	±15	V

figure 19. **IGBT**

IGBT transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



At

D =	t_p / T	
$R_{th(j-s)}$ =	0,22	K/W

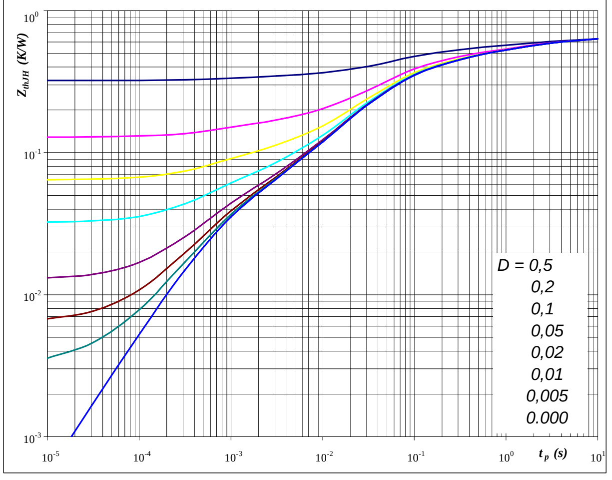
IGBT thermal model values

R (K/W)	Tau (s)
0,04	4,0E+00
0,05	9,4E-01
0,04	2,3E-01
0,07	5,4E-02
0,02	1,6E-02
0,01	2,8E-03

figure 20. **FWD**

FWD transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



At

D =	t_p / T	
$R_{th(j-s)}$ =	0,64	K/W

FWD thermal model values

R (K/W)	Tau (s)
0,09	4,6E+00
0,11	1,2E+00
0,16	1,8E-01
0,23	3,8E-02
0,03	5,8E-03
0,03	7,4E-04

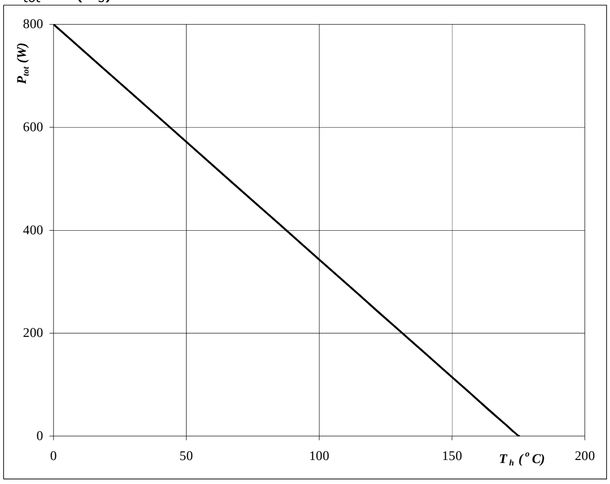
Half Bridge

Half Bridge IGBT and Neutral Point FWD

figure 21. **IGBT**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



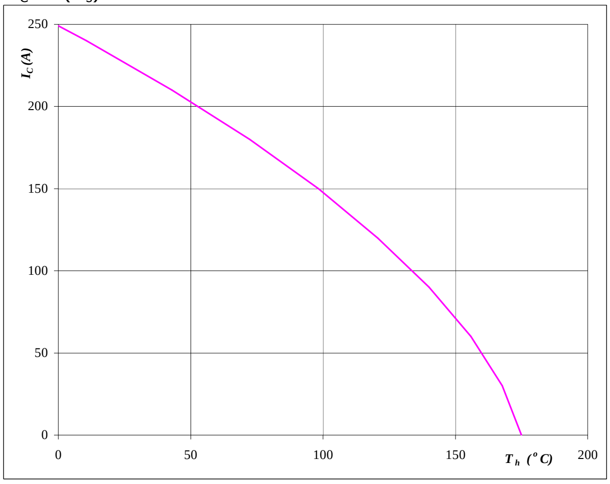
At

T_j = 175 °C

figure 22. **IGBT**

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

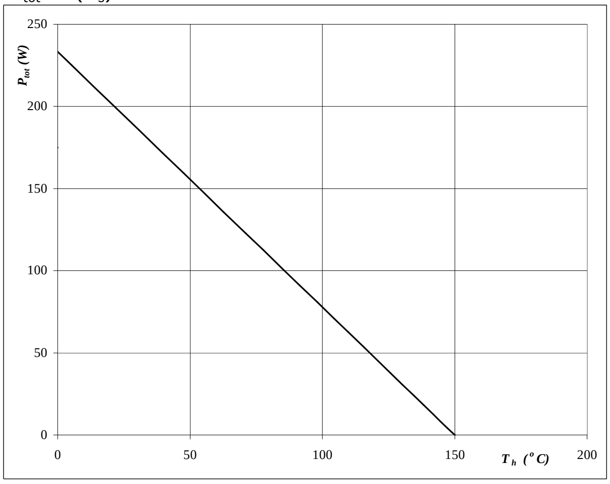
T_j = 175 °C

V_{GE} = 15 V

figure 23. **FWD**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



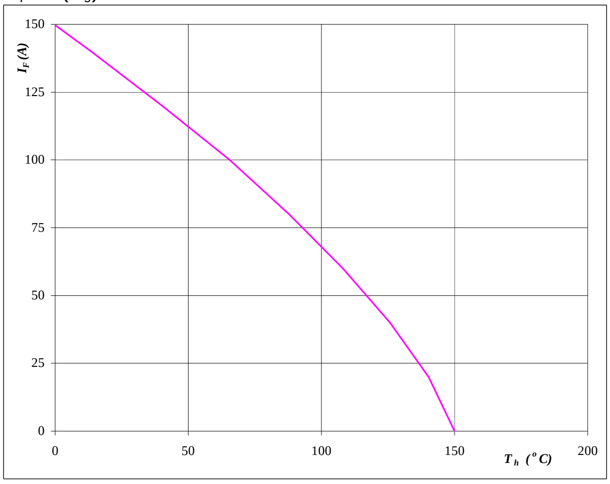
At

T_j = 150 °C

figure 24. **FWD**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

T_j = 150 °C

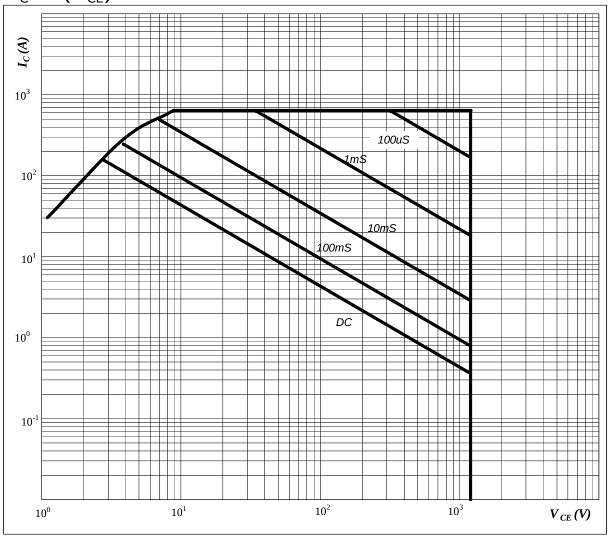
Half Bridge

Half Bridge IGBT and Neutral Point FWD

figure 25. **IGBT**

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



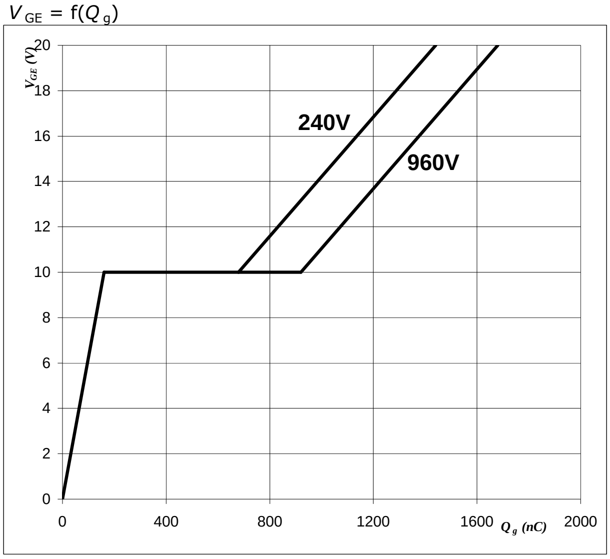
At

D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	ºC

figure 26. **IGBT**

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



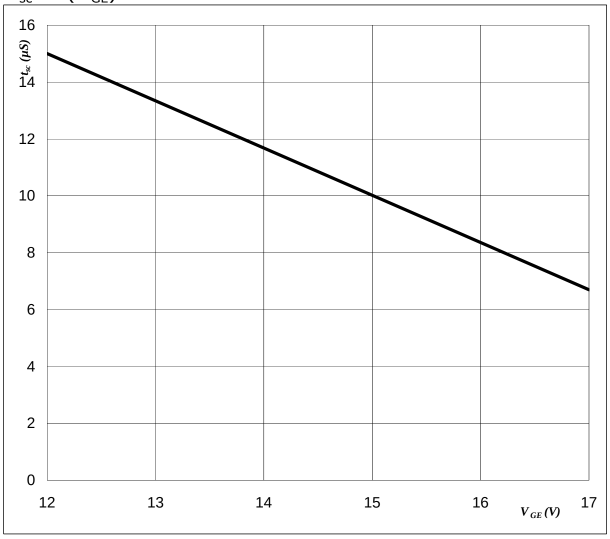
At

I_D =	160	A
T_j=	25	ºC

figure 27. **IGBT**

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

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



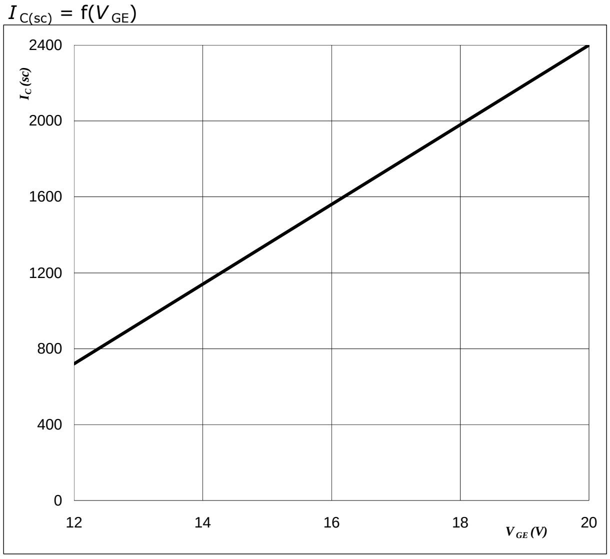
At

V_{CE} =	1200	V
T_j ≤	175	ºC

figure 28. **IGBT**

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

$I_{C(sc)} = f(V_{GE})$



At

V_{CE} ≤	1200	V
T_j =	175	ºC

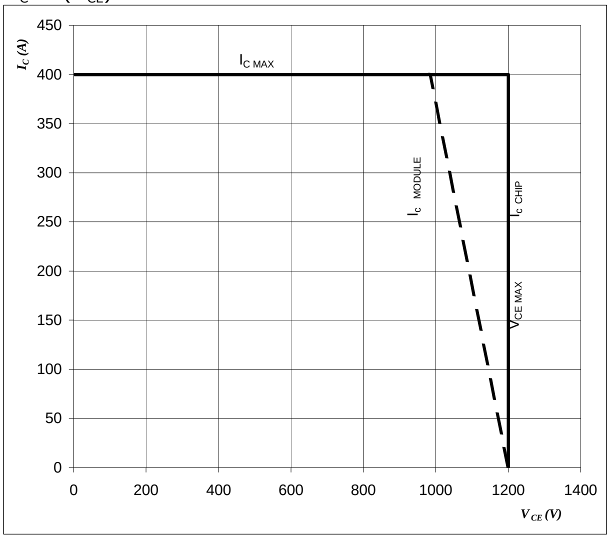
Half Bridge

Half Bridge IGBT and Neutral Point FWD

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

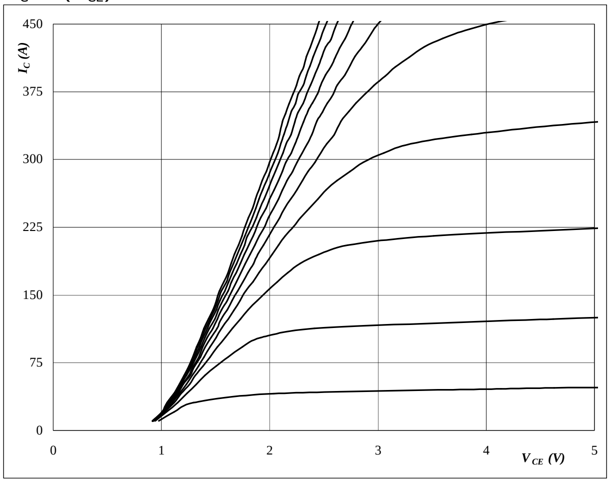
Neutral Point

Neutral Point IGBT and Half Bridge FWD

figure 1.	IGBT

Typical output characteristics

I_C = f(V_{CE})



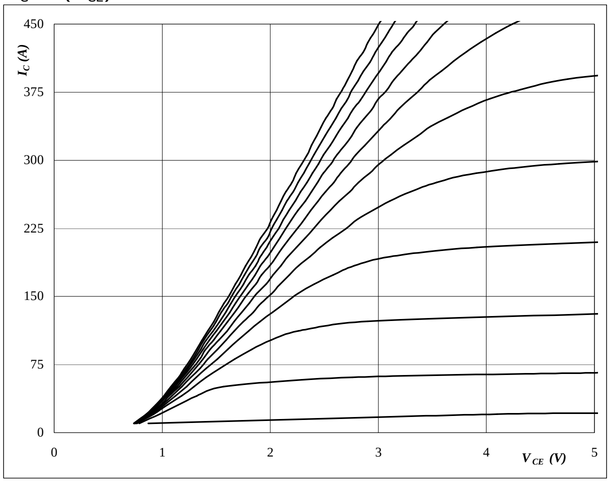
At

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})



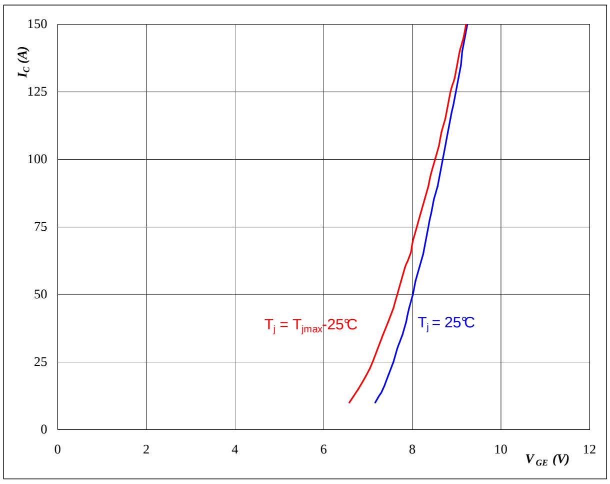
At

t_p = 250 µs
T_j = 150 °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})



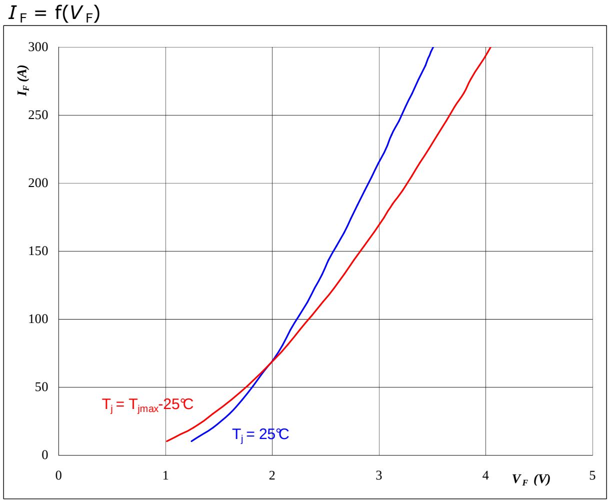
At

t_p = 250 µs
V_{CE} = 0 V
T_j = 25/150 °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 = 25/150 °C

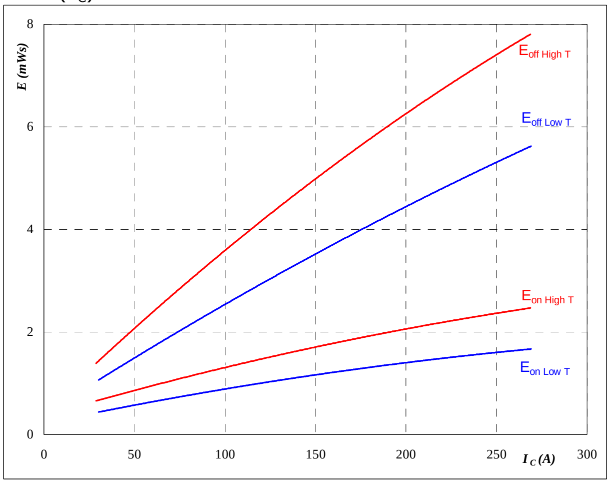
Neutral Point

Neutral Point IGBT and Half Bridge FWD

figure 5. **IGBT**

Typical switching energy losses
as a function of collector current

E = f(I_C)



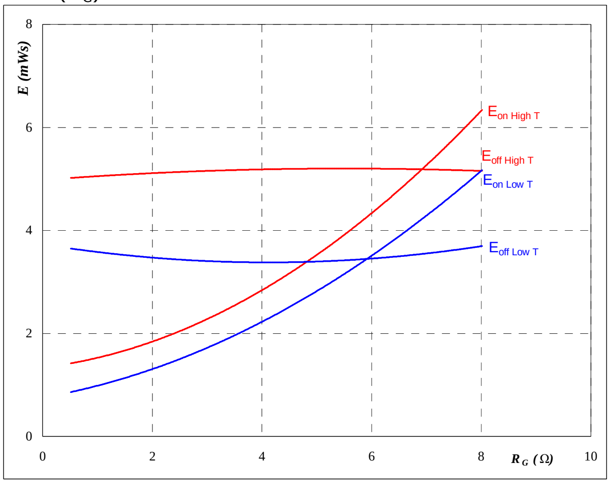
With an inductive load at

T_j =	25/126	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

figure 6. **IGBT**

Typical switching energy losses
as a function of gate resistor

E = f(R_G)



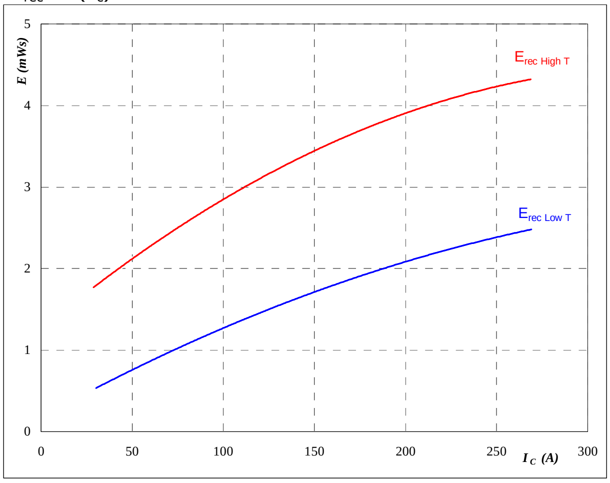
With an inductive load at

T_j =	25/126	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	151	A

figure 7. **FWD**

Typical reverse recovery energy loss
as a function of collector current

E_{rec} = f(I_c)



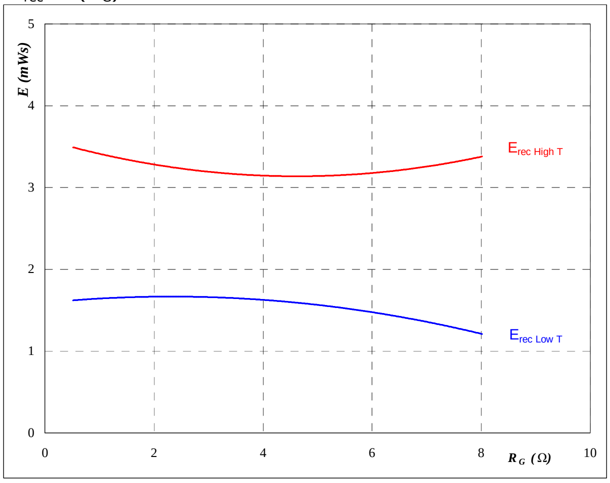
With an inductive load at

T_j =	25/126	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	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 =	25/126	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	151	A

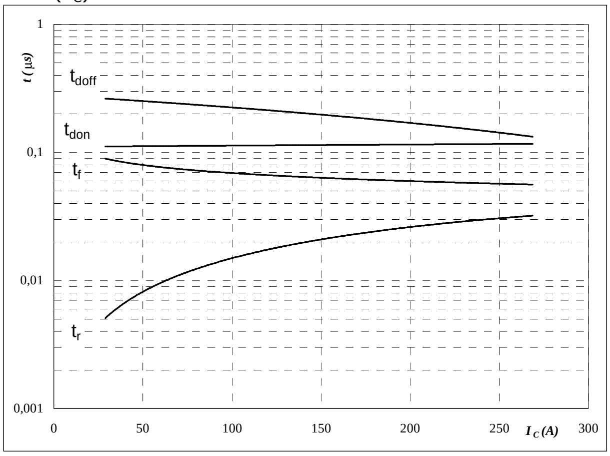
Neutral Point

Neutral Point IGBT and Half Bridge FWD

figure 9. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



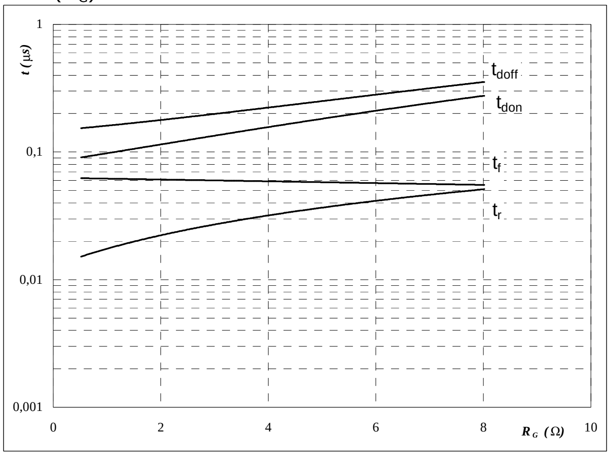
With an inductive load at

T_j =	126	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω
R_{goff} =	2	Ω

figure 10. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_G)$



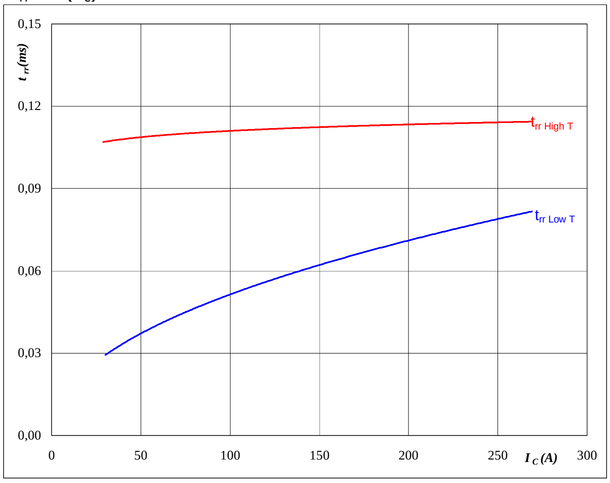
With an inductive load at

T_j =	126	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	151	A

figure 11. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$



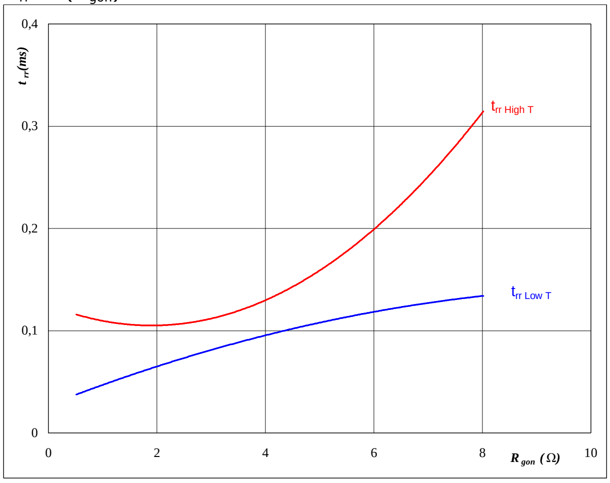
At

T_j =	25/126	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	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 =	25/126	°C
V_R =	350	V
I_F =	151	A
V_{GE} =	±15	V

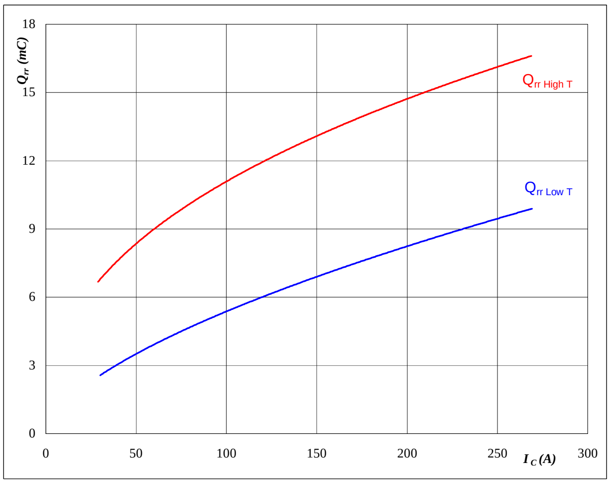
Neutral Point

Neutral Point IGBT and Half Bridge FWD

figure 13. **FWD**

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



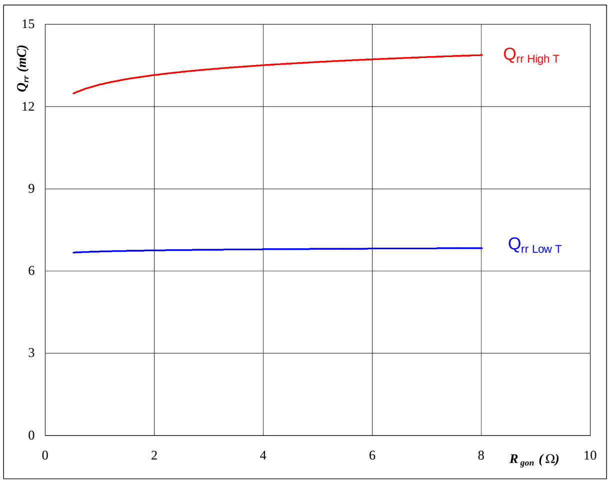
At

T_j =	25/126	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

figure 14. **FWD**

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

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



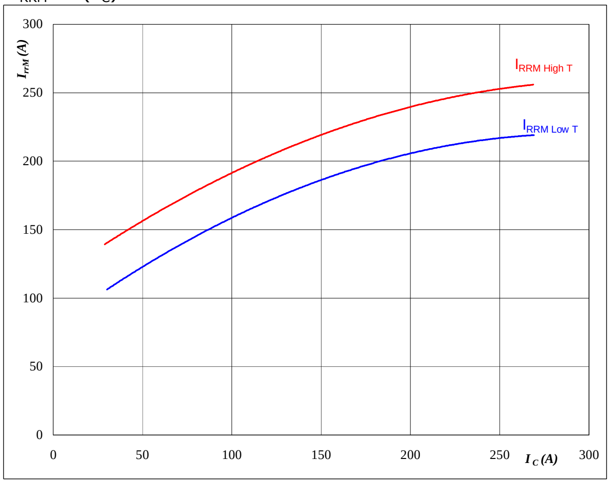
At

T_j =	25/126	°C
V_R =	350	V
I_F =	151	A
V_{GE} =	±15	V

figure 15. **FWD**

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



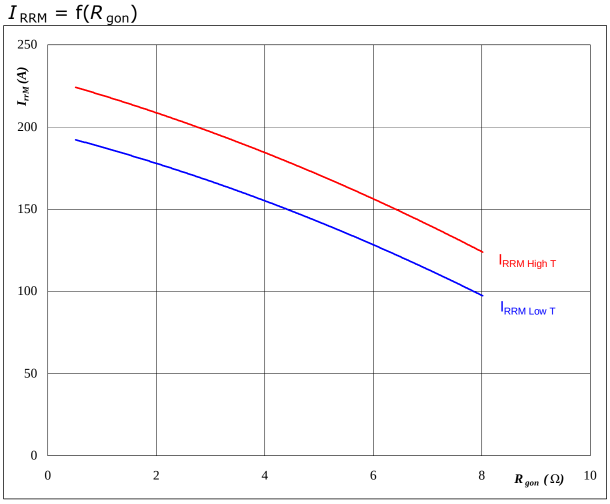
At

T_j =	25/126	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	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 =	151	A
V_{GE} =	±15	V

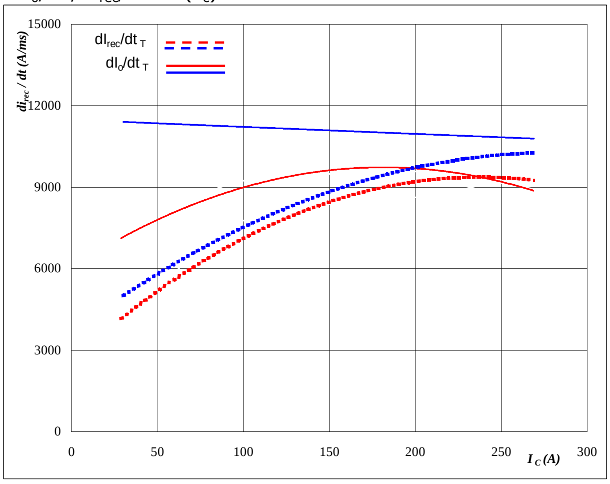
Neutral Point

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

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



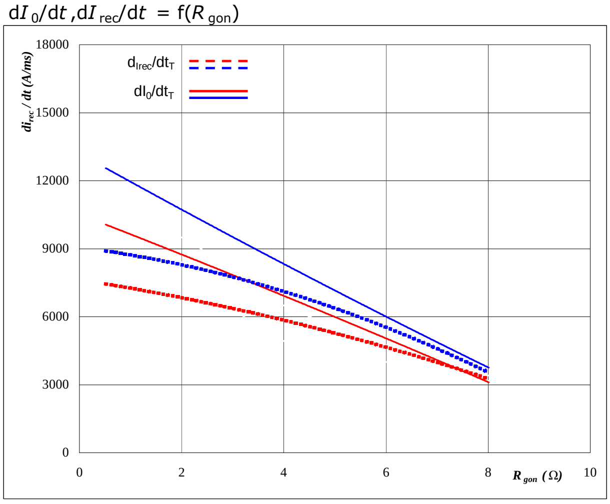
At

T_j =	25/126	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	2	Ω

figure 18. **FWD**

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

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



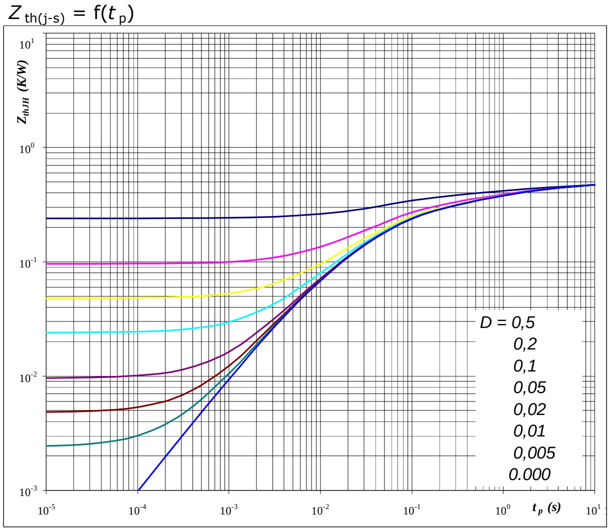
At

T_j =	25/126	°C
V_R =	350	V
I_F =	151	A
V_{GE} =	±15	V

figure 19. **IGBT**

IGBT transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



At

D =	t_p / T	
$R_{th(j-s)}$ =	0,48	K/W

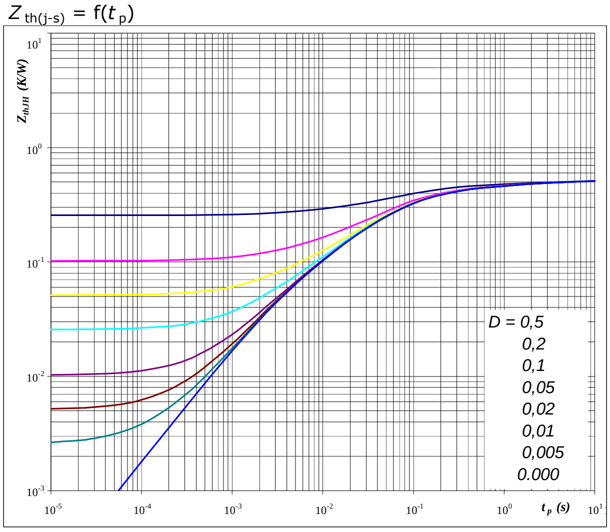
IGBT thermal model values

R (K/W)	Tau (s)
0,09	4,40
0,11	0,76
0,10	0,13
0,15	0,03
0,02	0,01

figure 20. **FWD**

FWD transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



At

D =	t_p / T	
$R_{th(j-s)}$ =	0,51	K/W

FWD thermal model values

R (K/W)	Tau (s)
0,06	3,05
0,08	0,45
0,20	0,09
0,14	0,03
0,04	0,004

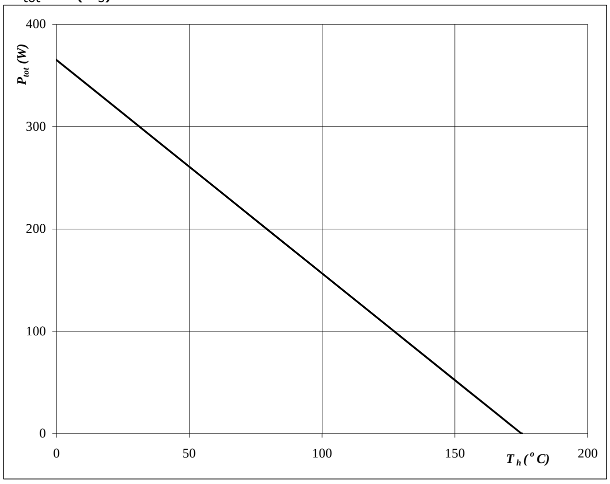
Neutral Point

Neutral Point IGBT and Half Bridge FWD

figure 21.	**IGBT**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



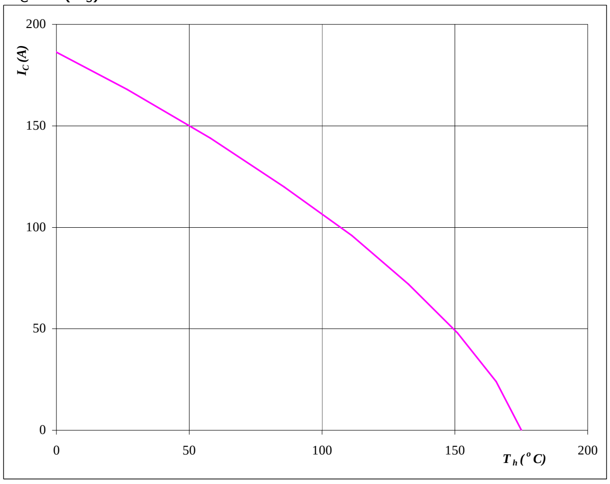
At

T_j = 175 ºC

figure 22.	**IGBT**

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

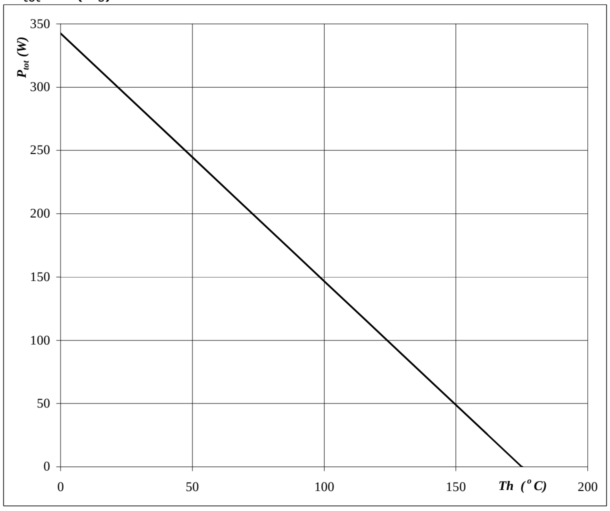
T_j = 175 ºC

V_{GE} = 15 V

figure 23.	**FWD**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



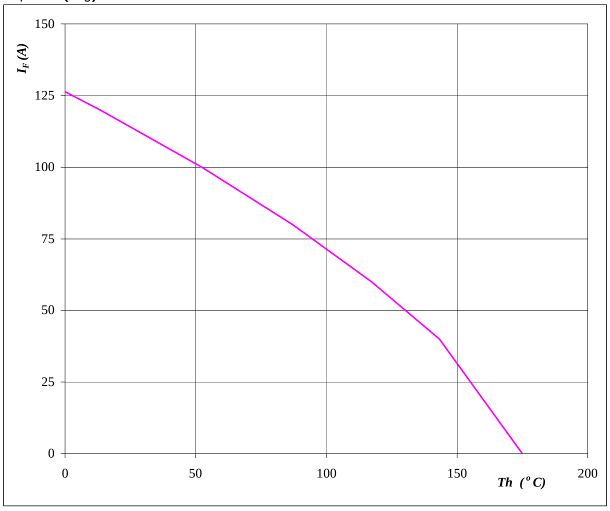
At

T_j = 175 ºC

figure 24.	**FWD**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

T_j = 175 ºC

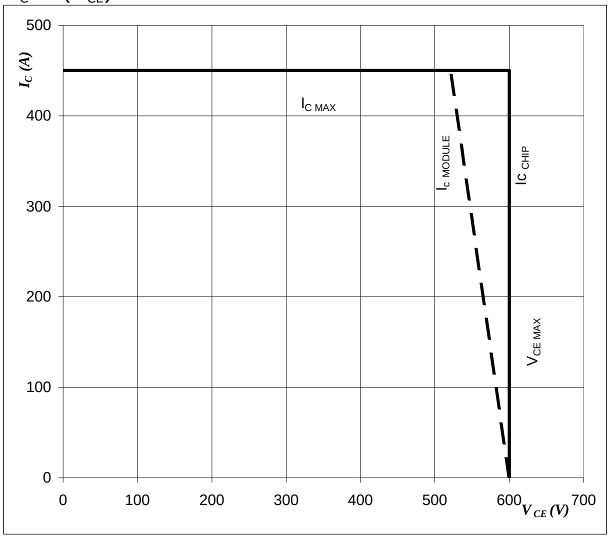
Neutral Point

neutral point IGBT

figure 25. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



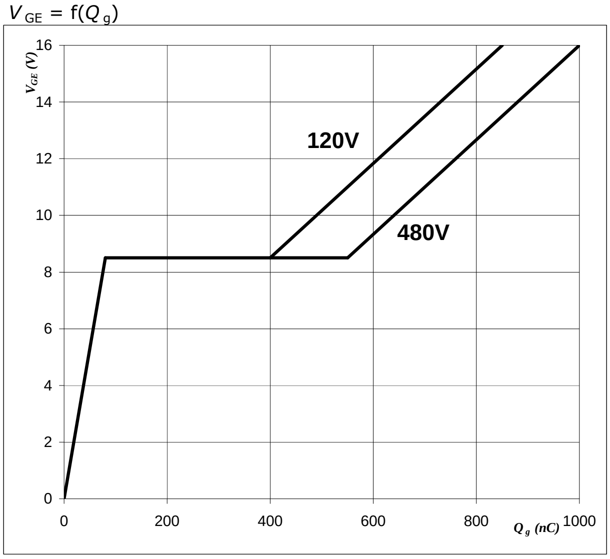
At

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

figure 26. **IGBT**

Gate voltage vs Gate charge

$V_{GE} = f(Q_g)$



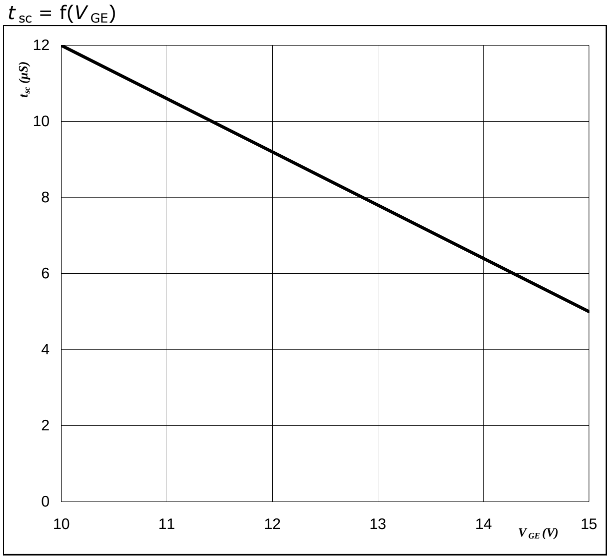
At

I_D =	150	A
T_j=	25	ºC

figure 27. **IGBT**

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

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



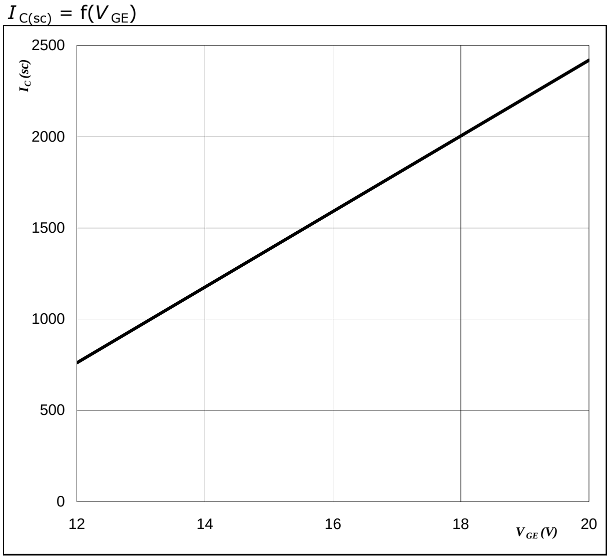
At

V_{CE} ≤	400	V
T_j ≤	150	ºC

figure 28. **IGBT**

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

$I_{C(sc)} = f(V_{GE})$



At

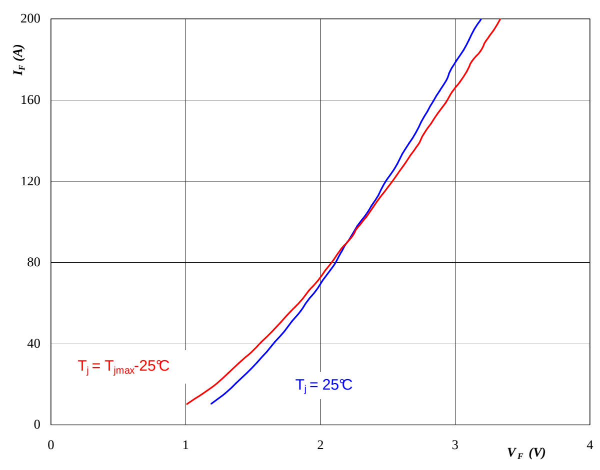
V_{CE} ≤	400	V
T_j =	150	ºC

Neutal Point IGBT Inverse Diode

figure 25. **IGBT**

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



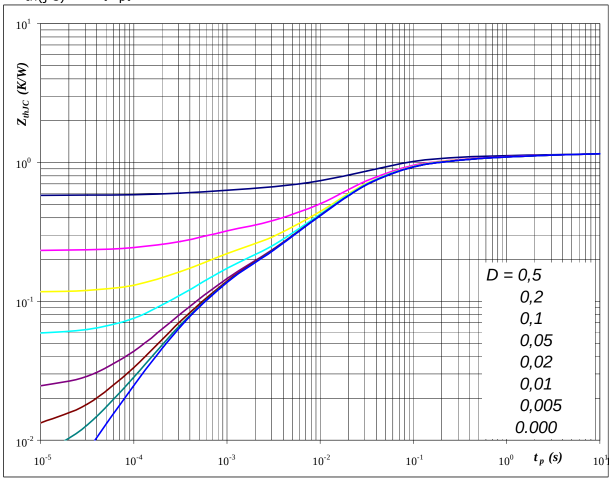
At

t_p = 250 µs

figure 26. **IGBT**

FWD transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



At

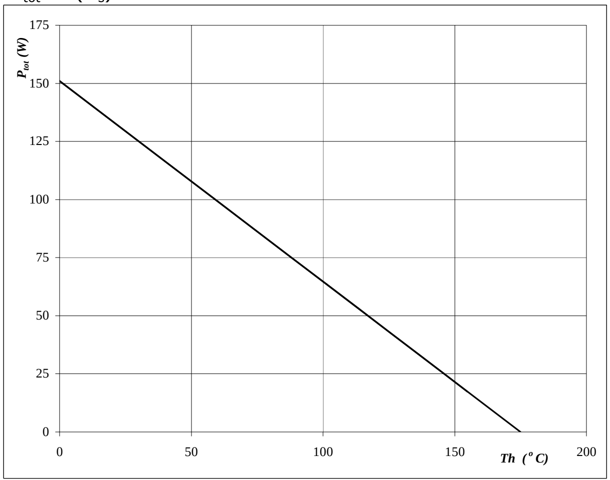
D = t_p / T

$R_{th(j-s)}$ = 1,16 K/W

figure 27. **IGBT**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



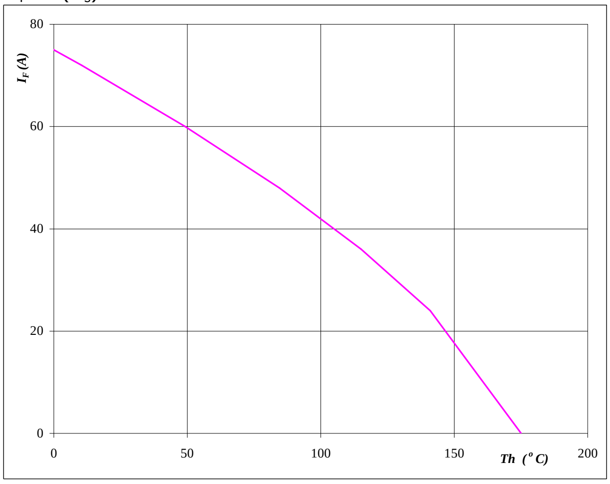
At

T_j = 175 ºC

figure 28. **IGBT**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

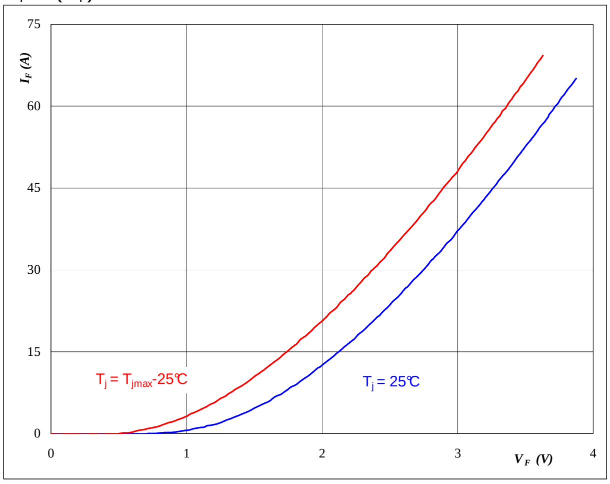
T_j = 175 ºC

Half Bridge Inverse Diode

figure 1. **IGBT**

Typical FWD forward current as a function of forward voltage

$I_F = f(V_F)$



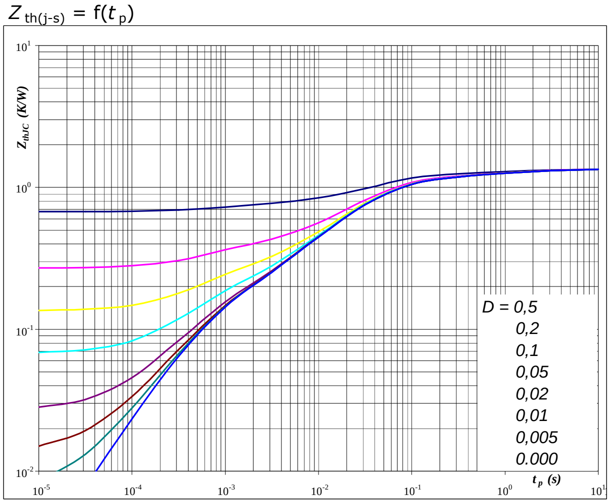
At

t_p = 250 µs

figure 2. **IGBT**

FWD transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



At

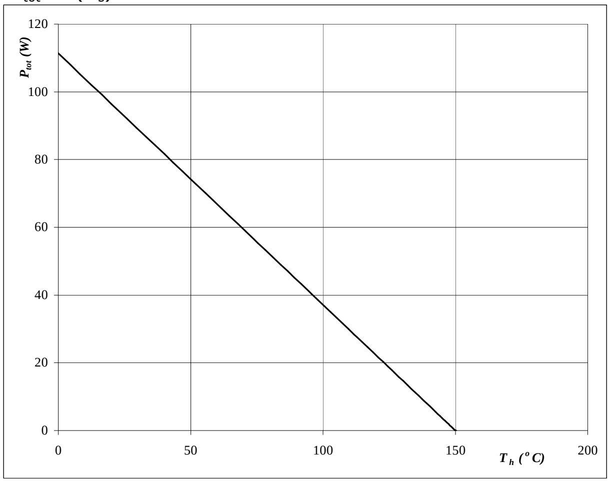
$D = t_p / T$

$R_{th(j-s)}$ = 1,35 K/W

figure 3. **IGBT**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



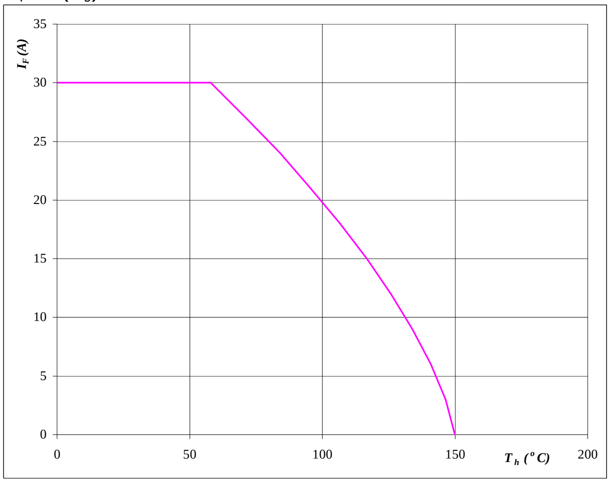
At

T_j = 150 ºC

figure 4. **IGBT**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

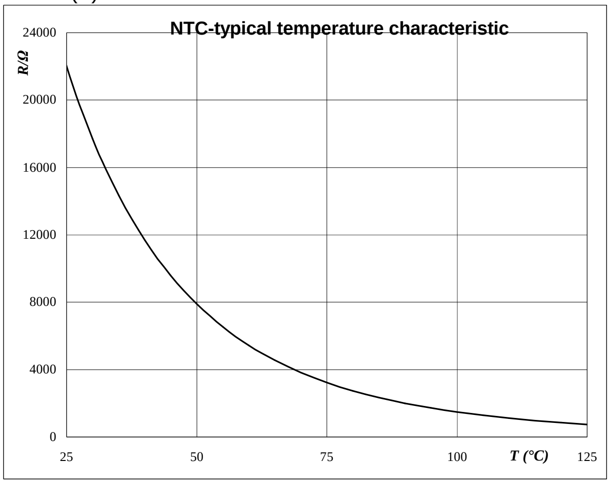
T_j = 150 ºC

Thermistor

figure 1.	Thermistor

Typical NTC characteristic
as a function of temperature

$R_T = f(T)$



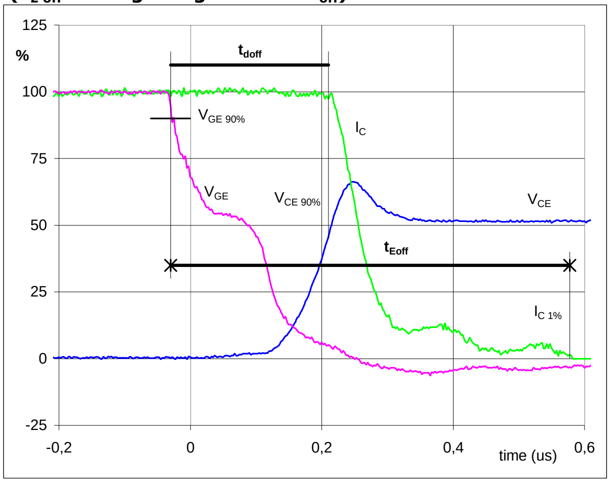
Switching Definitions Half Bridge

General conditions

T_j	=	125 °C
R_{gon}	=	2 Ω
R_{goff}	=	2 Ω

figure 1. **IGBT**

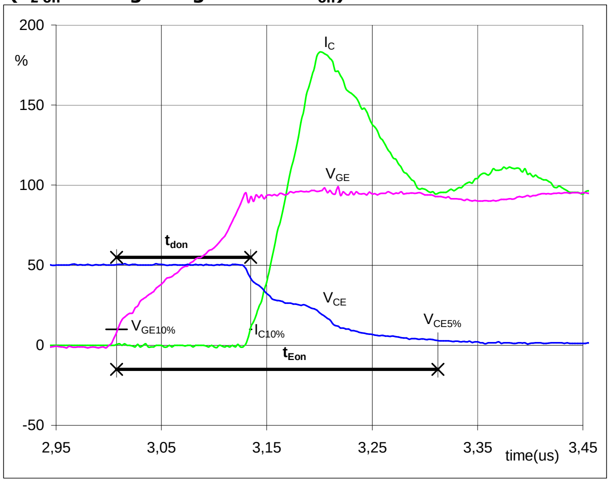
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	198	A
t_{doff} =	0,23	μs
$t_{E\,off}$ =	0,61	μs

figure 2. **IGBT**

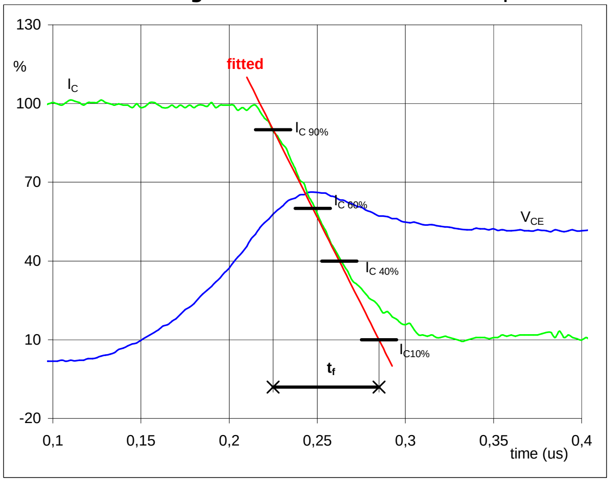
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	198	A
t_{don} =	0,13	μs
$t_{E\,on}$ =	0,30	μs

figure 3. **IGBT**

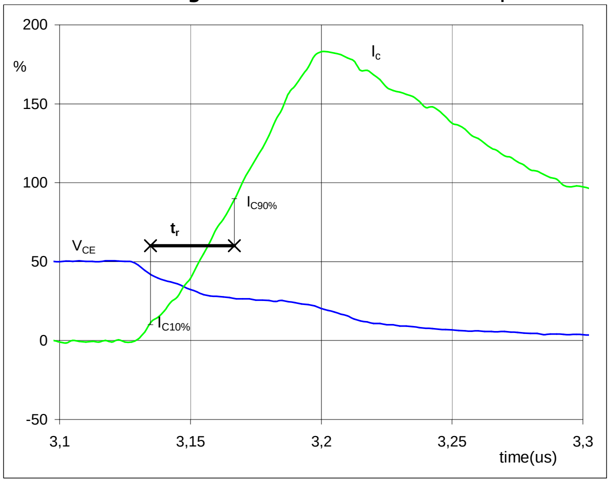
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	700	V
I_C (100%) =	198	A
t_f =	0,06	μs

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

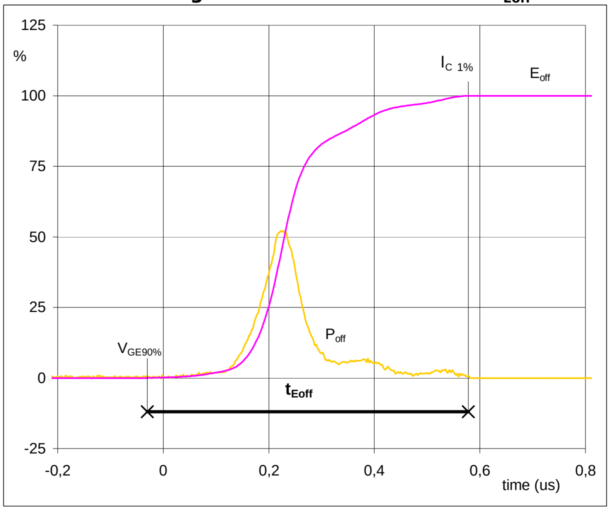


V_C (100%) =	700	V
I_C (100%) =	198	A
t_r =	0,03	μs

Switching Definitions Half Bridge

figure 5. **IGBT**

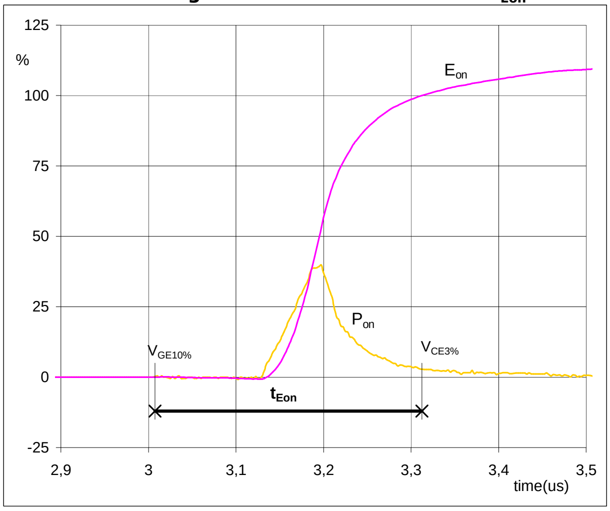
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	138,85	kW
E_{off} (100%) =	7,97	mJ
$t_{E\,off}$ =	0,61	μs

figure 6. **IGBT**

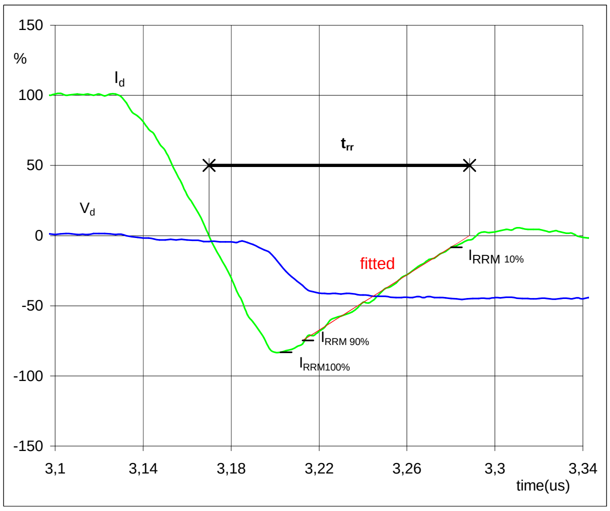
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	138,85	kW
E_{on} (100%) =	4,20	mJ
$t_{E\,on}$ =	0,30	μs

figure 7. **FWD**

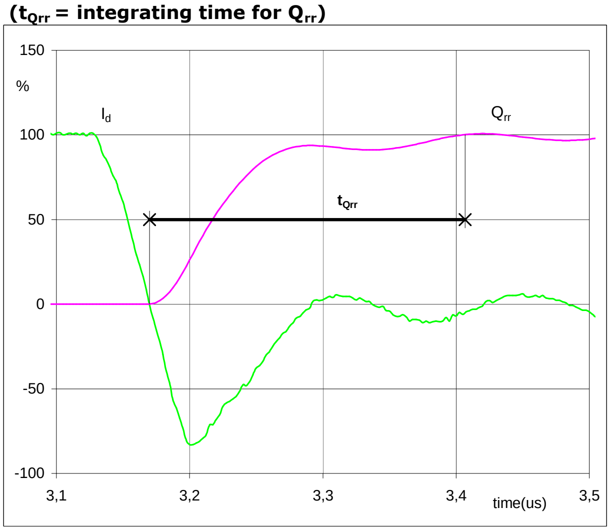
Turn-off Switching Waveforms & definition of t_{rr}



V_d (100%) =	700	V
I_d (100%) =	198	A
I_{RRM} (100%) =	-169	A
t_{rr} =	0,12	μs

figure 8. **FWD**

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

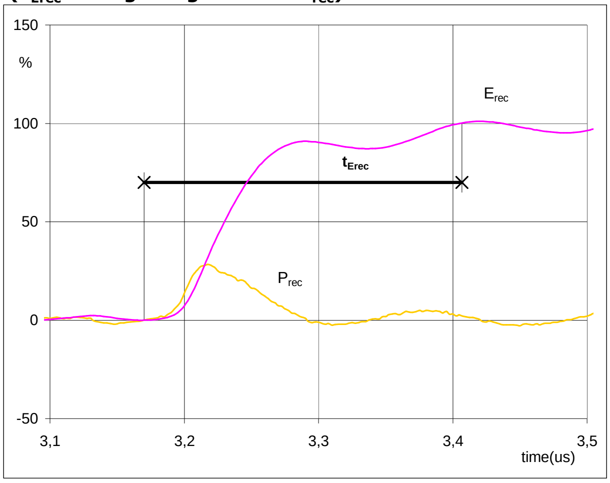


I_d (100%) =	198	A
Q_{rr} (100%) =	11,00	μC
$t_{Q\,rr}$ =	0,24	μs

Switching Definitions Half Bridge

figure 9.	FWD

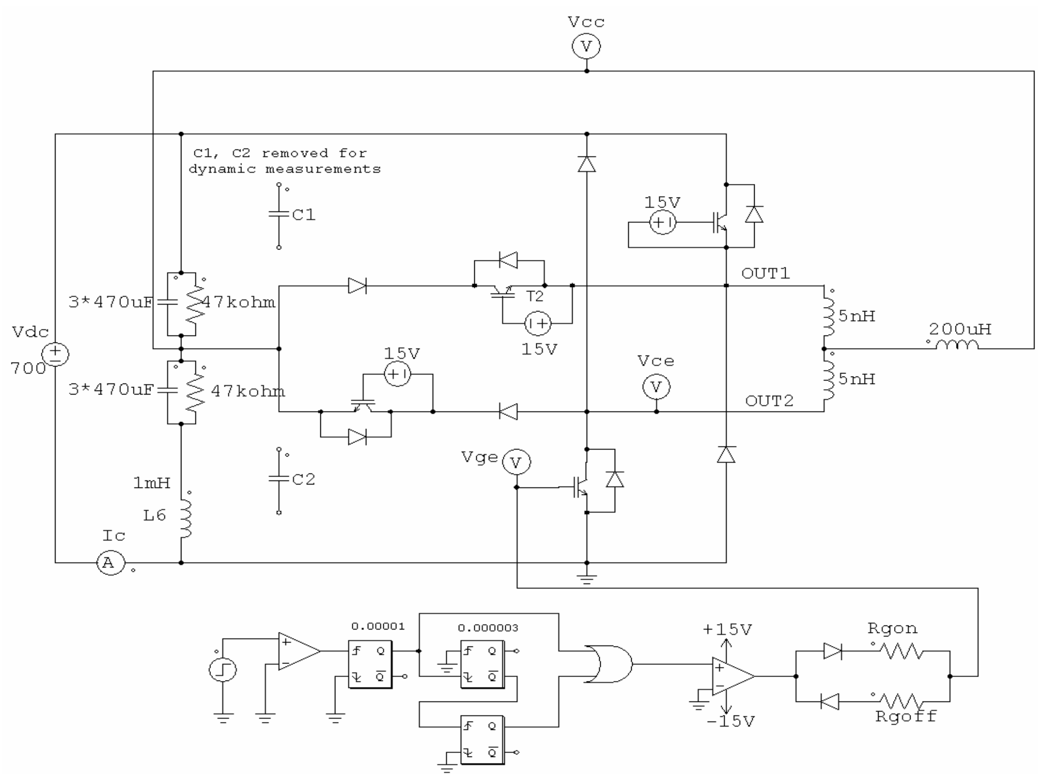
Turn-on Switching Waveforms & definition of t_{Erec}
(t_{Erec}= integrating time for E_{rec})



P_{rec} (100%) =	138,85	kW
E_{rec} (100%) =	2,39	mJ
$t_{E\,rec}$ =	0,24	μs

Half Bridge switching measurement circuit

figure 11.	IGBT



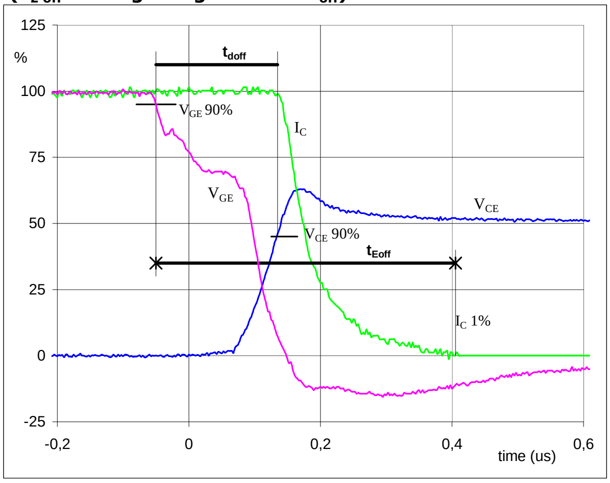
Switching Definitions Neutral Point IGBT

General conditions

T_j	=	125 °C
R_{gon}	=	4 Ω
R_{goff}	=	4 Ω

figure 1. **Neutral Point IGBT**

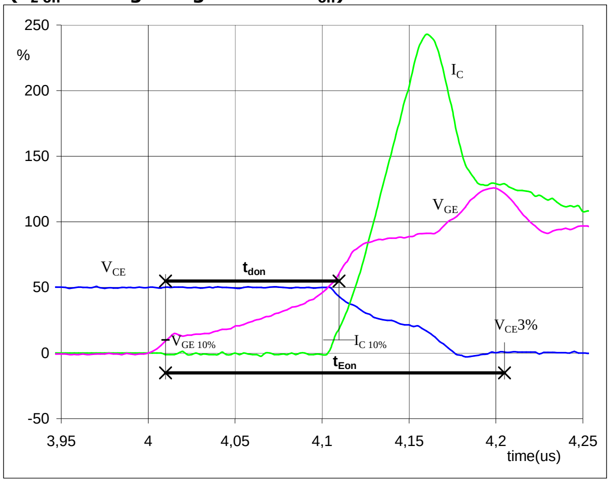
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	151	A
t_{doff} =	0,18	μs
$t_{E\,off}$ =	0,46	μs

figure 2. **Neutral Point IGBT**

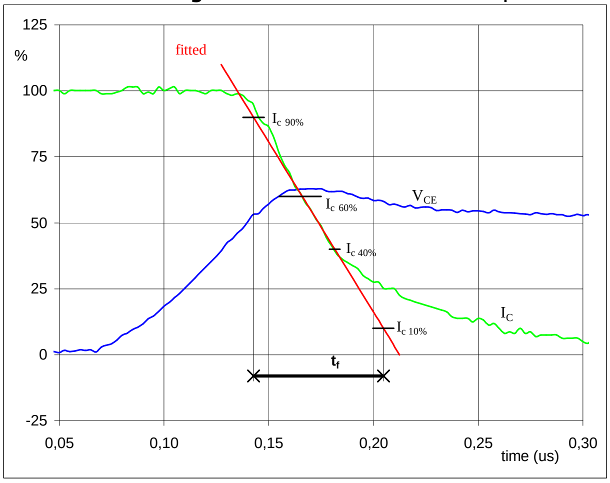
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	700	V
I_C (100%) =	151	A
t_{don} =	0,11	μs
$t_{E\,on}$ =	0,19	μs

figure 3. **Neutral Point IGBT**

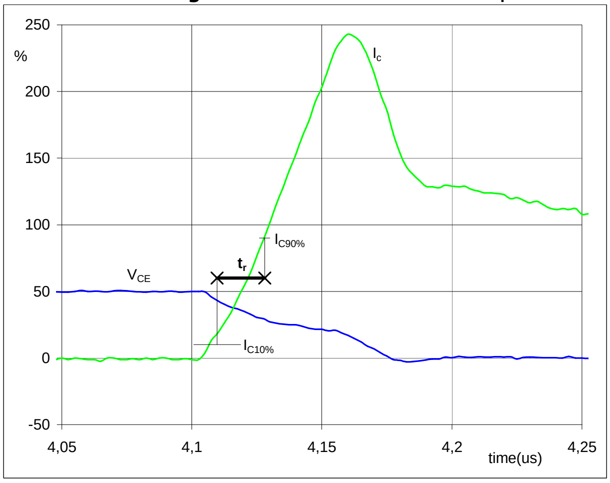
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	700	V
I_C (100%) =	151	A
t_f =	0,064	μs

figure 4. **Neutral Point IGBT**

Turn-on Switching Waveforms & definition of t_r

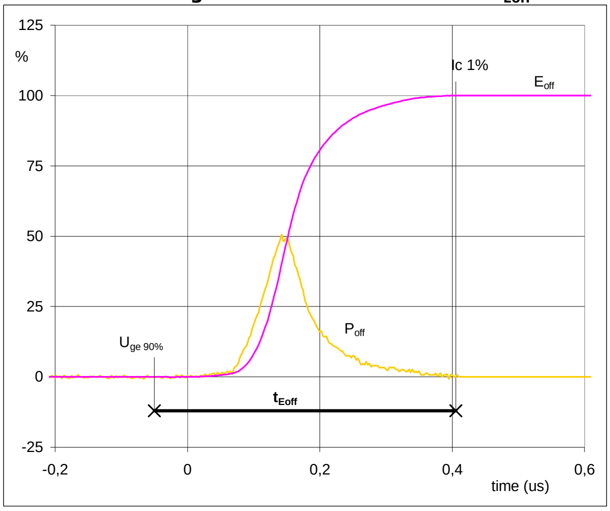


V_C (100%) =	700	V
I_C (100%) =	151	A
t_r =	0,019	μs

Switching Definitions Neutral Point IGBT

figure 5. **Neutral Point IGBT**

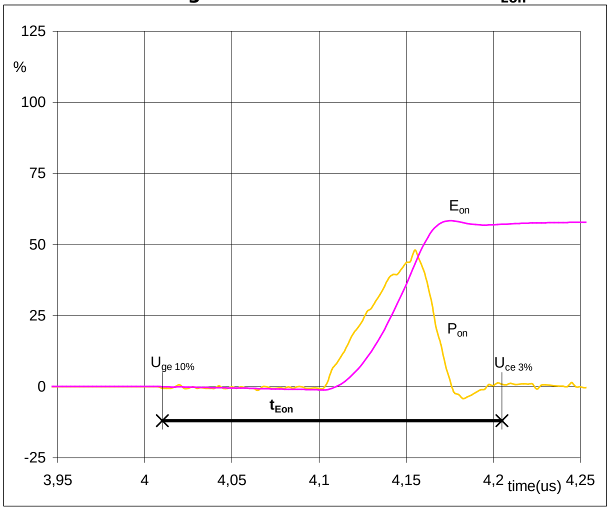
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	69,93	kW
E_{off} (100%) =	3,32	mJ
$t_{E\,off}$ =	0,44	μs

figure 6. **Neutral Point IGBT**

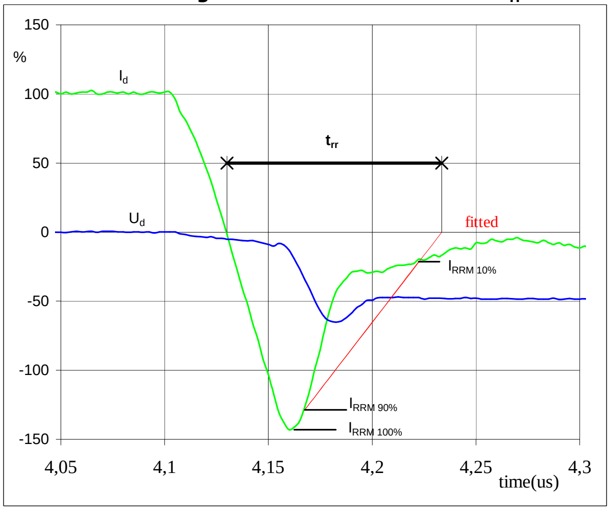
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	69,93	kW
E_{on} (100%) =	1,52	mJ
$t_{E\,on}$ =	0,18	μs

figure 7. **Half Bridge FWD**

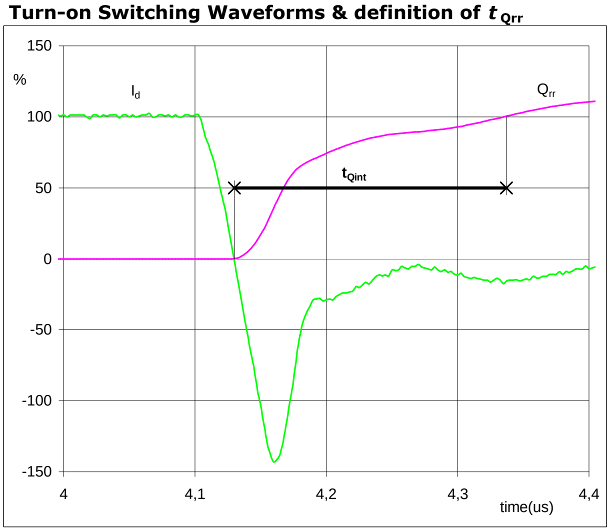
Turn-off Switching Waveforms & definition of t_{rr}



V_d (100%) =	700	V
I_d (100%) =	151	A
I_{RRM} (100%) =	-142	A
t_{rr} =	0,07	μs

figure 8. **Half Bridge FWD**

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

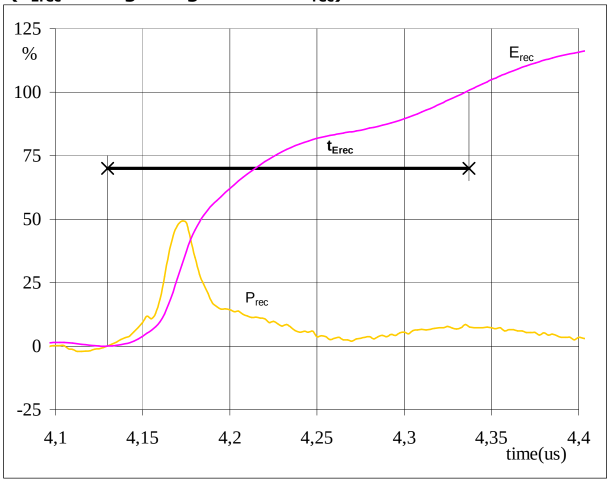


I_d (100%) =	151	A
Q_{rr} (100%) =	12,71	μC
t_{Qint} =	1,00	μs

Switching Definitions Neutral Point IGBT

figure 9. **Half Bridge FWD**

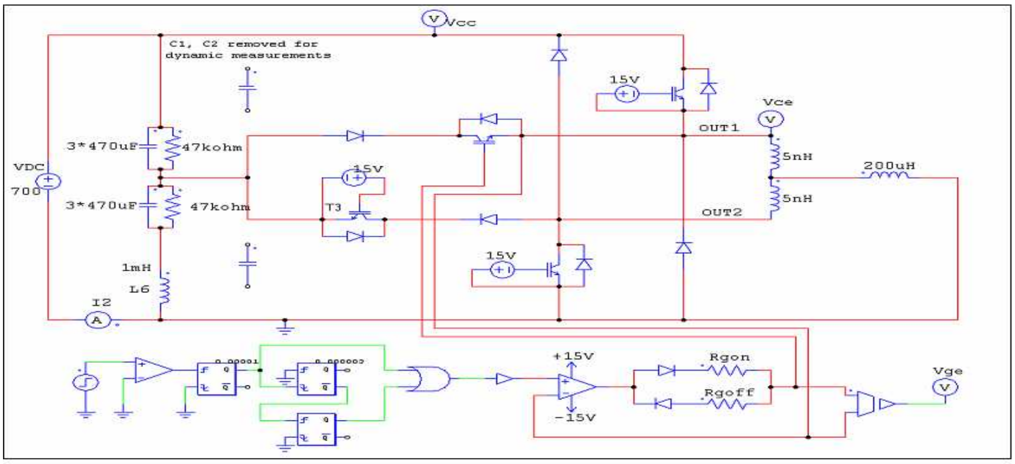
Turn-on Switching Waveforms & definition of t_{Erec}
(t_{Erec}= integrating time for E_{rec})



P_{rec} (100%) =	69,93	kW
E_{rec} (100%) =	3,61	mJ
$t_{E\,rec}$ =	1,00	μs

Neutral Point IGBT switching measurement circuit

figure 10. Neutral Point IGBT



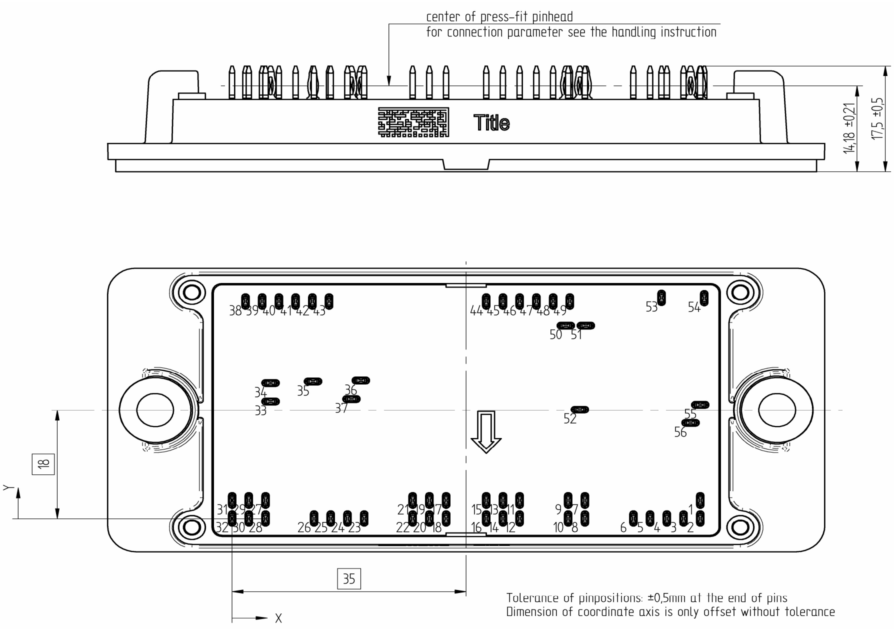
Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

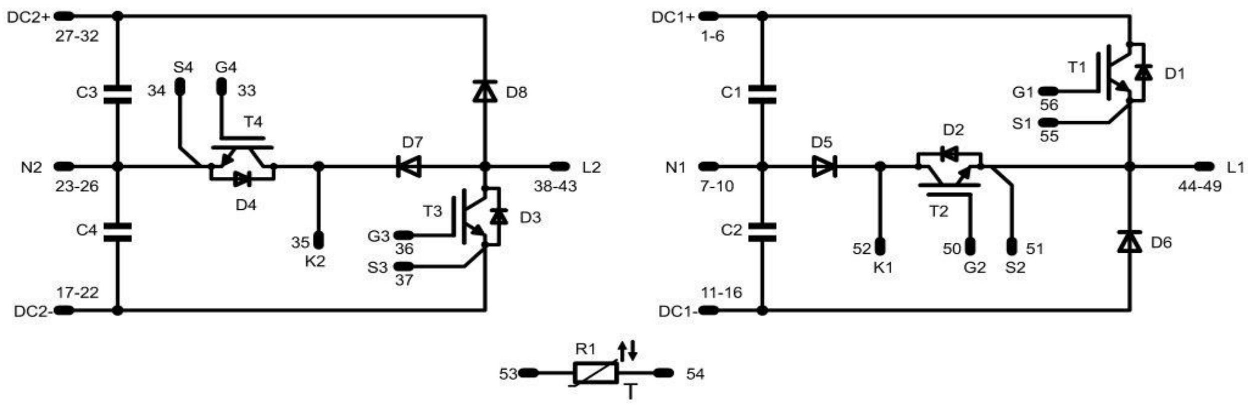
Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste with solder pins	30-FT12NMA200SH-M660F08	M660F08	M660F08
with thermal paste and solder pins	30-FT12NMA200SH-M660F08-/3/	M660F08	M660F08-/3/
without thermal paste with Press-fit pins	30-PT12NMA200SH-M660F08Y	M660F08Y	M660F08Y
with thermal paste and Press-fit pins	30-PT12NMA200SH-M660F08Y-/3/	M660F08Y	M660F08Y-/3/

Outline

Pin table			Pin table			Pin table		
Pin	X	Y	Pin	X	Y	Pin	X	Y
1	70	3	27	5	3			
2	70	0	28	5	0			
3	67,5	0	29	2,5	3			
4	65	0	30	2,5	0			
5	62,5	0	31	0	3			
6	60	0	32	0	0			
7	52,75	3	33	5,75	19,45			
8	52,75	0	34	5,75	22,45			
9	50,25	3	35	12,1	22,7			
10	50,25	0	36	19,25	22,85			
11	43	3	37	17,85	19,85			
12	43	0	38	2	36			
13	40,5	3	39	4,5	36			
14	40,5	0	40	7	36			
15	38	3	41	9,5	36			
16	38	0	42	12	36			
17	32	3	43	14,5	36			
18	32	0	44	38	36			
19	29,5	3	45	40,5	36			
20	29,5	0	46	43	36			
21	27	3	47	45,5	36			
22	27	0	48	48	36			
23	19,75	0	49	50,5	36	53	64,2	36,6
24	17,25	0	50	49,9	32	54	70,6	36,55
25	14,75	0	51	52,9	32	55	70	18,9
26	12,25	0	52	52	18,1	56	68,55	15,9



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1, T3	IGBT	1200V	200A	Half Bridge IGBT	
D1, D3	FWD	1200V	15A	HB IGBT Inverse Diode	
D5, D7	FWD	700V	150A	Neutral Point FWD	
T2, T4	IGBT	600V	150A	Neutral Point IGBT	
D6, D8	FWD	1200V	100A	Half Bridge FWD	
D2, D4	FWD	600V	50A	NP IGBT Inverse Diode	
R1	Resistor			Resistor	

Packaging instruction					
Standard packaging quantity (SPQ)	**36**	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 2 packages see vincotech.com website.

Package data
Package data for *flow* 2 packages see vincotech.com website.

UL recognition and file number
This device is certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
30-FT12NMA200SH-M660F08-D3-14	19 Mar. 2018	Pin number corrected on schematic	31