Vincotech

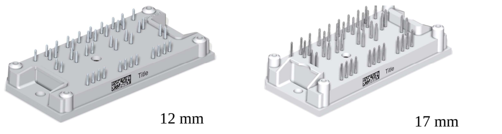
10-F112M3A025SH-M746F09
10-FY12M3A025SH-M746F08
datasheet

flow3xMNPC 1 **1200 V / 25 A**

Features

- 3 phase mixed voltage component topology
- neutral point clamped inverter
- reactive power capability
- low inductance layout

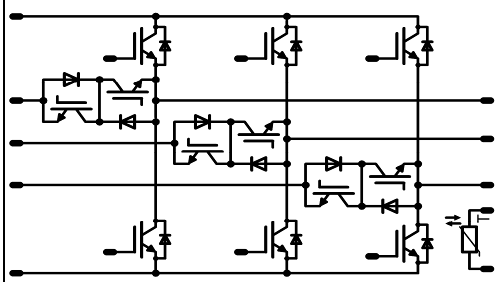
flow1 housing



Target Applications

- solar inverter
- UPS

Schematic



Types

- 10-FY12M3A025SH-M746F08
- 10-F112M3A025SH-M746F09

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Half Bridge IGBT (T1,T4,T5,T8,T9,T12)					
Collector-emitter break down voltage	V_{CES}			1200	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	23	A
Pulsed collector current	I_{CRM}	t_p limited by T_{jmax}		75	A
Turn off safe operating area		T_j ≤ 150 °C $V_{CE} <= V_{CES}$		75	A
Power dissipation per IGBT	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	58	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
Neutral P. FWD (D2,D3,D6,D7,D10,D11)					
Peak Repetitive Reverse Voltage	V_{RRM}			600	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	17	A
Surge forward current	I_{FRM}	t_p limited by T_{jmax}	T_j = 100 °C	150	A
Power dissipation per Diode	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	28	W
Maximum Junction Temperature	T_{jmax}			150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Neutral P. IGBT (T2,T3,T6,T7,T10,T11)					
Collector-emitter break down voltage	V_{CES}			600	V
DC collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	18	A
Pulsed collector current	I_{CRM}	t_p limited by T_{jmax}		60	A
Turn off safe operating area		T_j ≤ 150 °C $V_{CE} <= V_{CES}$		60	A
Power dissipation per IGBT	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	31	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
Half Bridge FWD (D1,D4,D5,D8,D9,D12)					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
DC forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	10	A
Surge forward current	I_{FRM}	t_p limited by T_{jmax}		36	A
Power dissipation per Diode	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	26	W
Maximum Junction Temperature	T_{jmax}			175	°C
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{op}			-40…+(T_{jmax} - 25)	°C
Insulation Properties					
Insulation voltage	V_{is}	t = 2 s	DC Test Voltage	4000	V
Creepage distance				min 12,7	mm
Clearance				min 12,7	mm

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 IGBT (T1,T4,T5,T8,T9										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00085	25 125	5,2	5,8	6,4	V
Collector-emitter saturation voltage	V_{CEsat}		15		25	25 125	1,7	2,11 2,42	2,4	V
Collector-emitter cut-off current	I_{CES}		0	1200		25 125			0,0024	mA
Gate-emitter leakage current	I_{GES}		20	0		25 125			120	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	15	25 125		73 74		ns
Rise time	t_r					25 125		15 18		ns
Turn-off delay time	$t_{d(off)}$					25 125		166 220		ns
Fall time	t_f					25 125		21 116		ns
Turn-on energy loss per pulse	E_{on}					25 125		0,17 0,30		mWs
Turn-off energy loss per pulse	E_{off}					25 125		0,37 0,63		mWs
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		1430		pF
Output capacitance	C_{oss}							99		pF
Reverse transfer capacitance	C_{rss}							85		pF
Gate charge	Q_G		±15	960	25	25		155		nC
Thermal resistance chip to heatsink per chip	$R_{th(j-s)}$	Thermal grease thickness≤50um λ = 1 W/mK						1,64		K/W
Neutral P. FWD (D2,D3,D6,D7,D1										
Diode forward voltage	V_F				15	25 125		2,47 1,73	2,6	V
Reverse leakage current	I_r			600		25 150			10	μA
Peak reverse recovery current	I_{RRM}	$R_{gon} = 16\ \Omega$	±15	350	15	25 125		16 22		A
Reverse recovery time	t_{rr}					25 125		23 33		ns
Reverse recovered charge	Q_{rr}					25 125		0,19 0,44		μC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		1860 1998		A/μs
Reverse recovered energy	E_{rec}					25 125		0,03 0,05		mWs
Thermal resistance chip to heatsink per chip	$R_{th(j-s)}$	Thermal grease thickness≤50um λ = 1 W/mK						2,48		K/W

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
Neutral P. IGBT (T2,T3,T6,T7,T10										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0012	25 125	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		20	25 125	1,1	1,53 1,70	1,9	V
Collector-emitter cut-off	I_{CES}		0	600		25 125			0,0011	mA
Gate-emitter leakage current	I_{GES}		20	0		25 125			300	nA
Integrated Gate resistor	R_{gint}							none		Ω
Turn-on delay time	$t_{d(on)}$	R_{goff} = 16 Ω R_{gon} = 16 Ω	±15	350	15	25 125		72 74		ns
Rise time	t_r					25 125		14 16		ns
Turn-off delay time	$t_{d(off)}$					25 125		131 157		ns
Fall time	t_f					25 125		34 69		ns
Turn-on energy loss per pulse	E_{on}					25 125		0,31 0,39		mWs
Turn-off energy loss per pulse	E_{off}					25 125		0,38 0,53		mWs
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		1100		pF
Output capacitance	C_{oss}							71		pF
Reverse transfer capacitance	C_{rss}							32		pF
Gate charge	Q_G		15	480	20	25		120		nC
Thermal resistance chip to heatsink per chip	$R_{th(j-s)}$	Thermal grease thickness≤50um						3,09		K/W
Half Bridge FWD (D1,D4,D5,D8,D										
Diode forward voltage	V_F				8	25 125		2,18 2,30	2,65	V
Reverse leakage current	I_r			1200		25 125			60	µA
Peak reverse recovery current	I_{RRM}	R_{gon} = 16 Ω	±15	350	15	25 125		21 24		A
Reverse recovery time	t_{rr}					25 125		29,9 34,7		ns
Reverse recovered charge	Q_{rr}					25 125		0,7 1,5		µC
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		1972 2214		A/µs
Reverse recovery energy	E_{rec}					25 125		0,14 0,38		mWs
Thermal resistance chip to heatsink per chip	$R_{th(j-s)}$	Thermal grease thickness≤50um λ = 1 W/mK						3,65		K/W
Thermistor										
Rated resistance	R					25		21511		Ω
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1486 Ω				100	-4,5		+4,5	%
Power dissipation	P					25		210		mW
Power dissipation constant						25		3,5		mW/K
B-value	B(25/50)					25		3884		K
B-value	B(25/100)					25		3964		K
Vincotech NTC Reference									F	

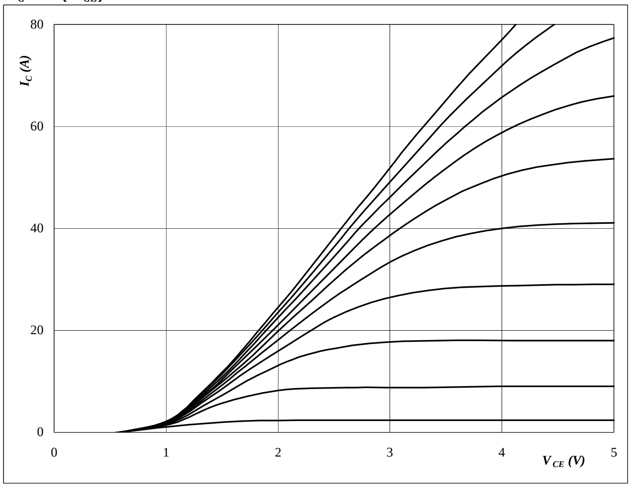
Half Bridge

Half Bridge IGBT & Neutral Point FWD

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



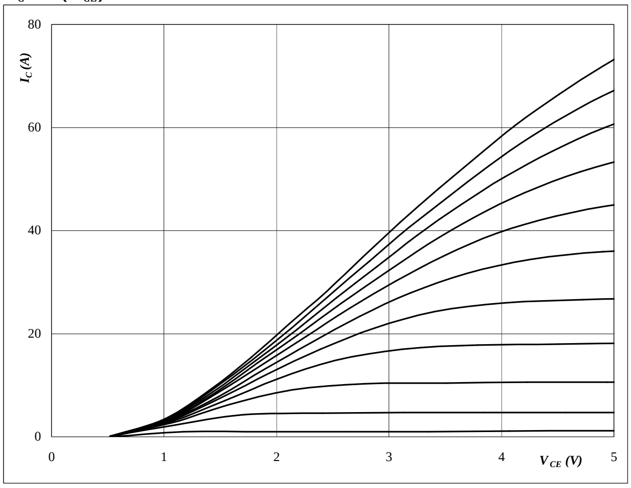
At

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

$I_C = f(V_{CE})$



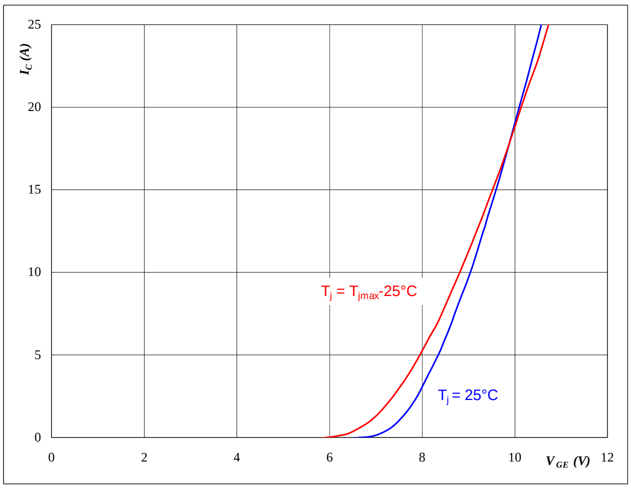
At

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

$I_C = f(V_{GE})$



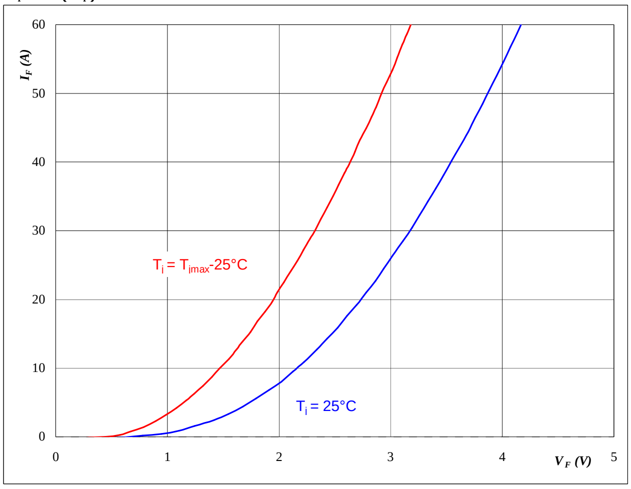
At

t_p =	250	µs
V_{CE} =	10	V

figure 4. **FWD**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

t_p =	250	µs

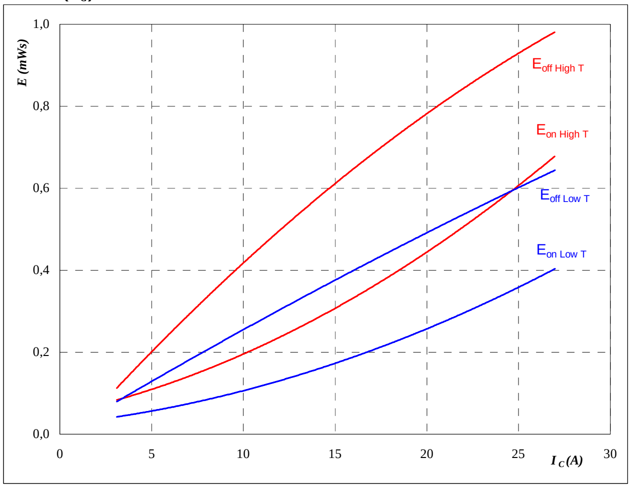
Half Bridge

Half Bridge IGBT & Neutral Point FWD

figure 5. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



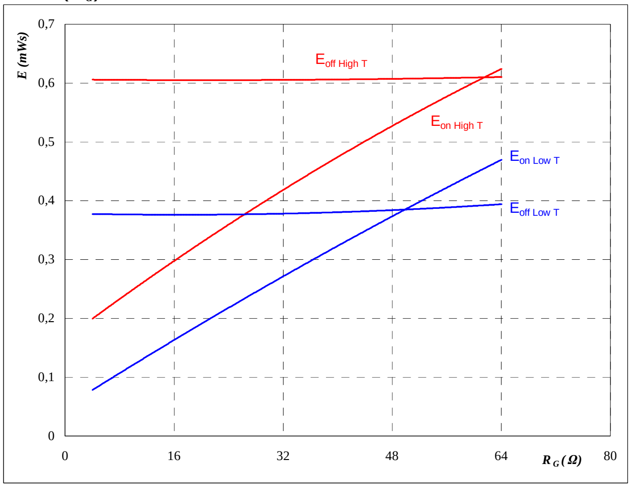
With an inductive load at

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

figure 6. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



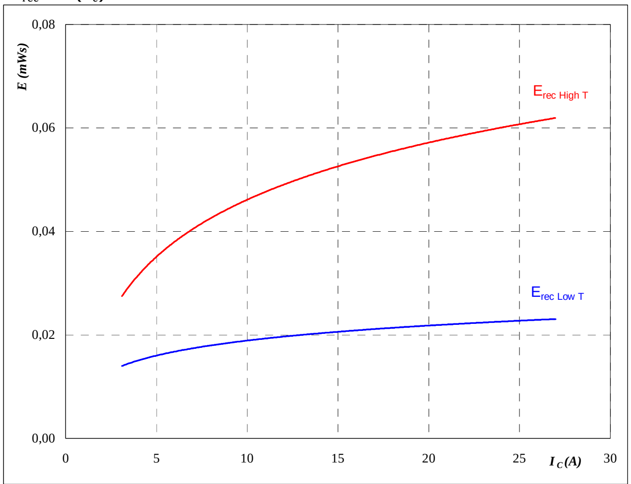
With an inductive load at

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

figure 7. **FWD**

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_c)$



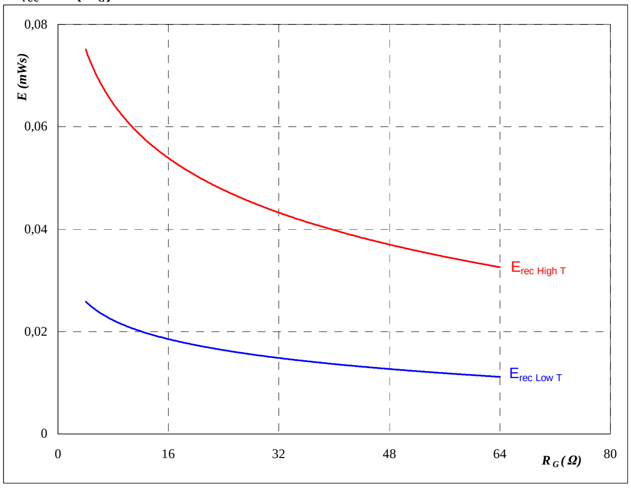
With an inductive load at

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 =	15	A

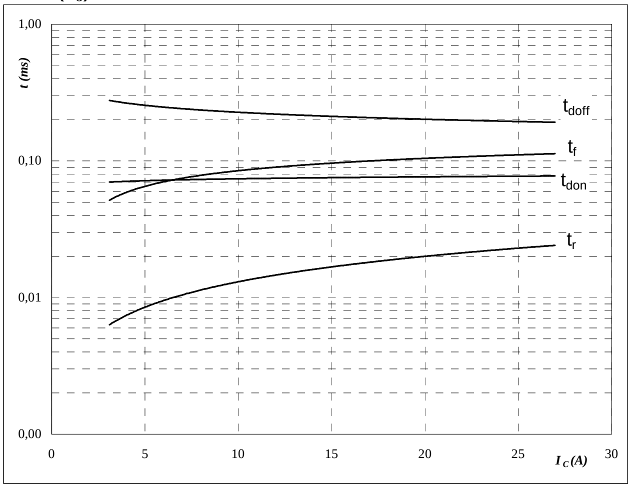
Half Bridge

Half Bridge IGBT & Neutral Point FWD

figure 9. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



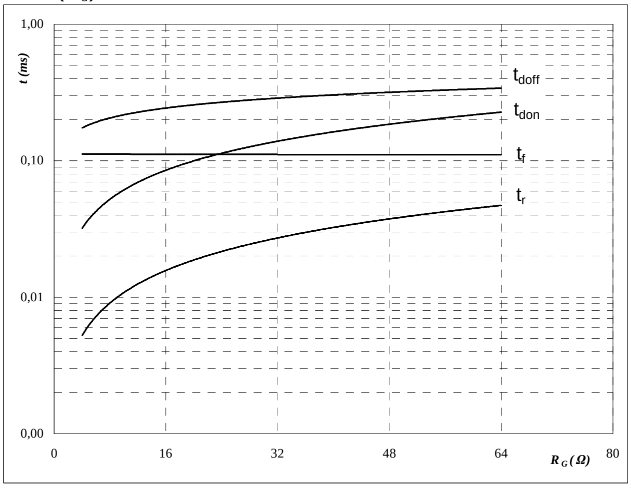
With an inductive load at

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

figure 10. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_G)$



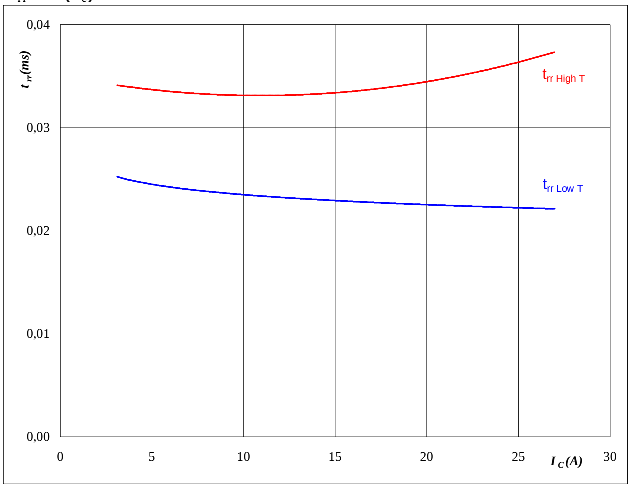
With an inductive load at

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

figure 11. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$



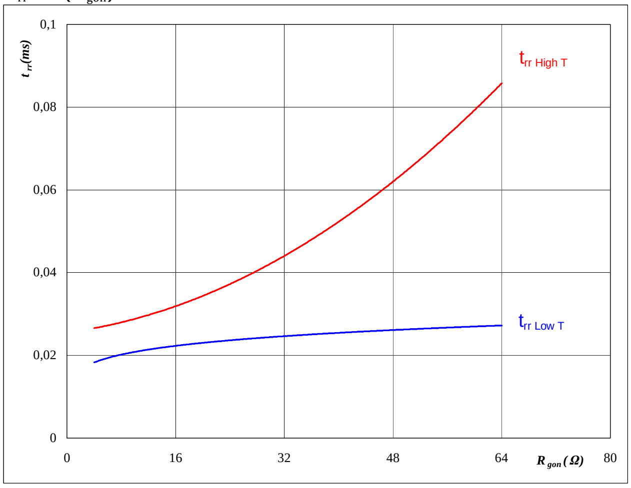
At

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 =	15	A
V_{GE} =	±15	V

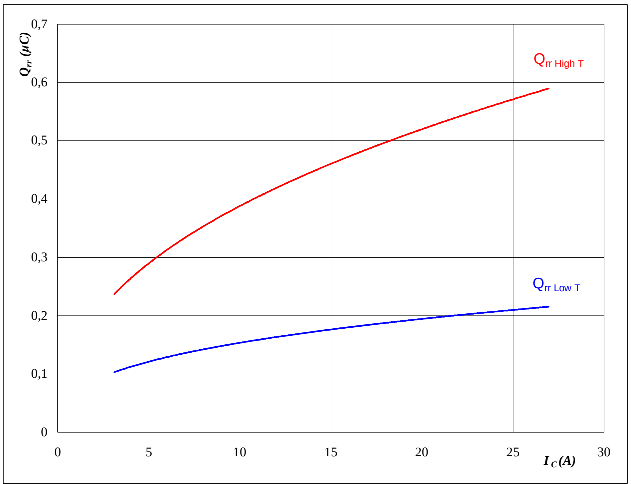
Half Bridge

Half Bridge IGBT & Neutral Point FWD

figure 13. FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



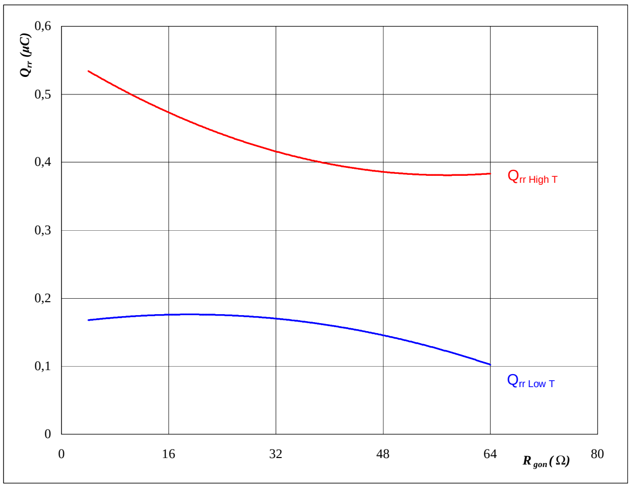
At

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

figure 14. FWD

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

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



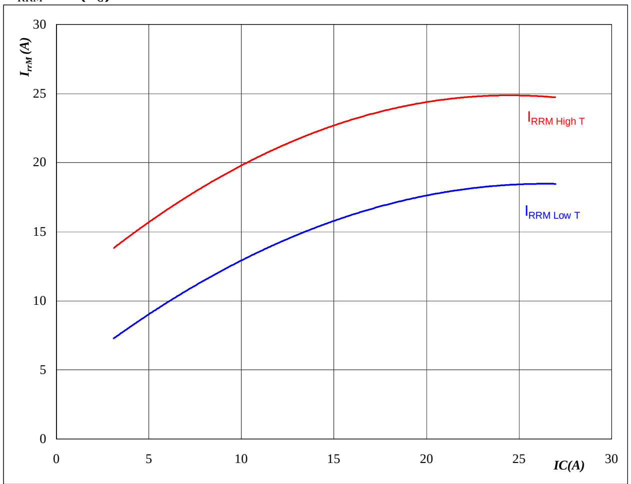
At

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

figure 15. FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



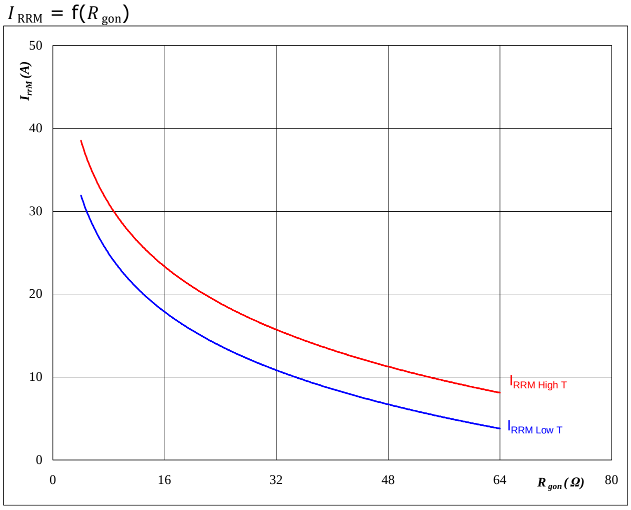
At

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

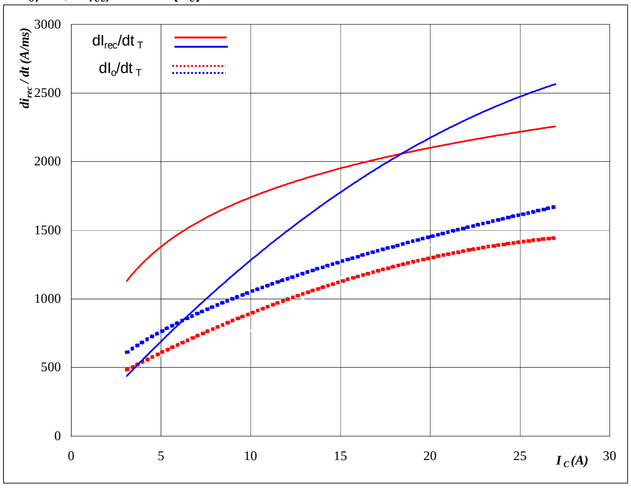
Half Bridge

Half Bridge IGBT & Neutral Point FWD

figure 17. **FWD**

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

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



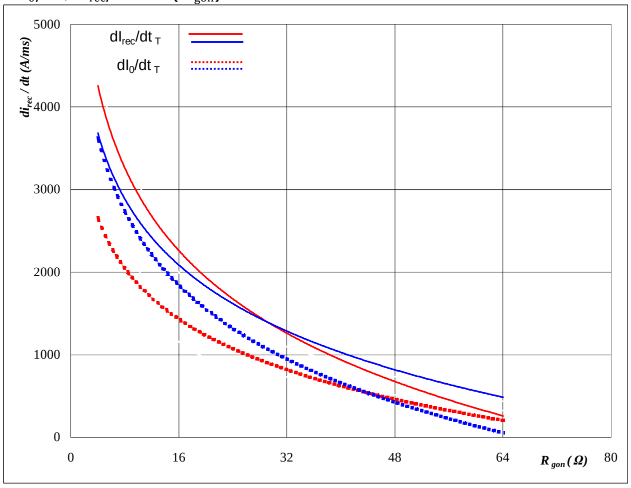
At

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

figure 18. **FWD**

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

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



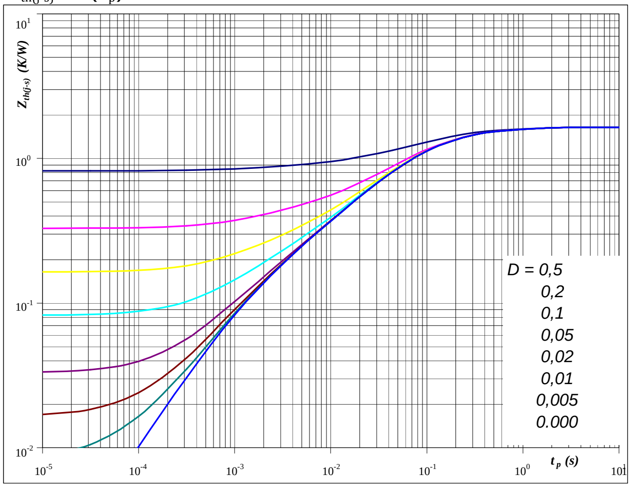
At

T_j =	25/125	°C
V_R =	350	V
I_F =	15	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	
$R_{th(j-s)}$ =	1,64	K/W

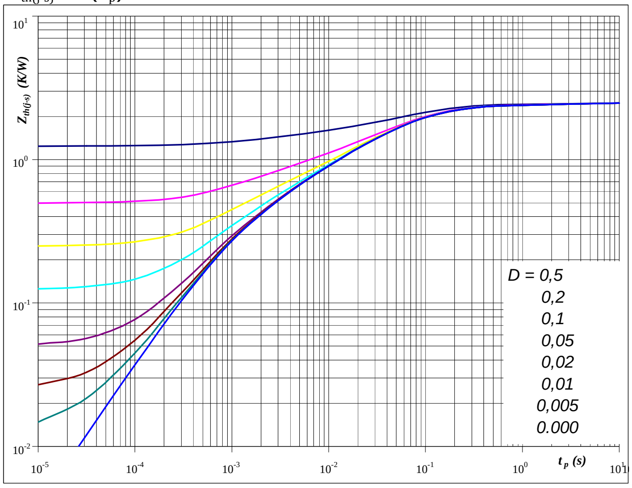
IGBT thermal model values

R (K/W)	Tau (s)
2,04E-01	7,24E-01
6,14E-01	1,26E-01
5,32E-01	4,64E-02
2,06E-01	9,84E-03
8,53E-02	1,28E-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	
$R_{th(j-s)}$ =	2,48	K/W

FWD thermal model values

R (K/W)	Tau (s)
7,74E-02	4,05E+00
1,56E-01	5,69E-01
1,07E+00	7,94E-02
6,06E-01	1,99E-02
3,14E-01	4,66E-03
2,53E-01	9,24E-04

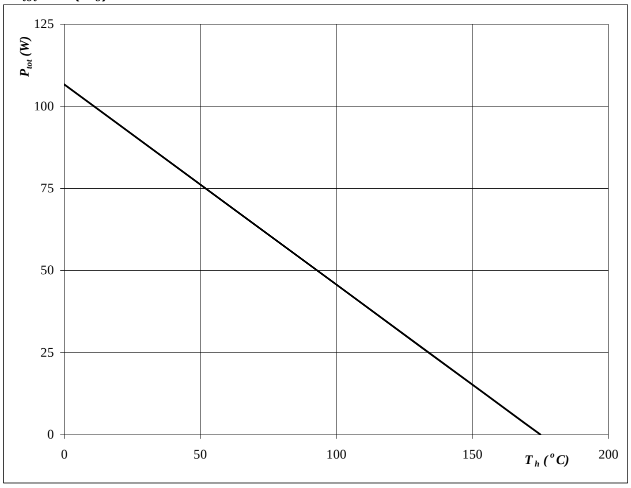
Half Bridge

Half Bridge IGBT & Neutral Point FWD

figure 21. IGBT

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



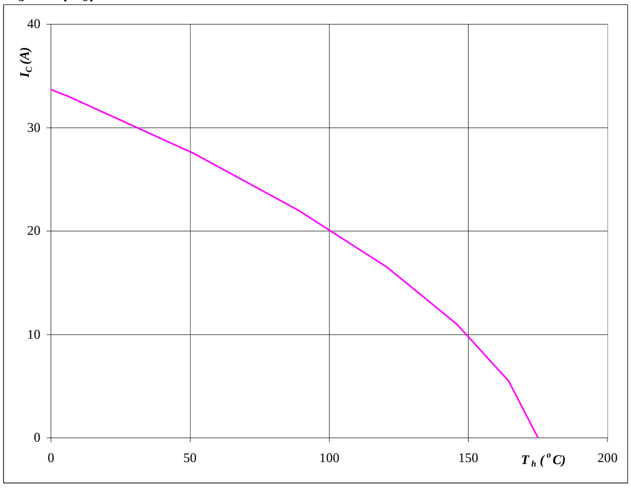
At

T_j = 175 °C

figure 22. IGBT

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

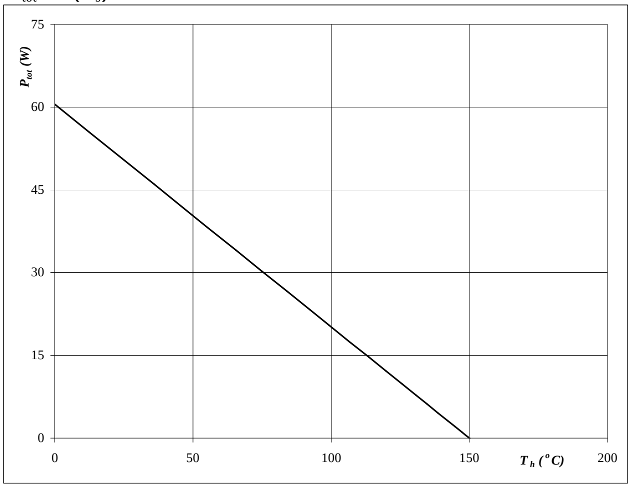
T_j = 175 °C

V_{GE} = 15 V

figure 23. FWD

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



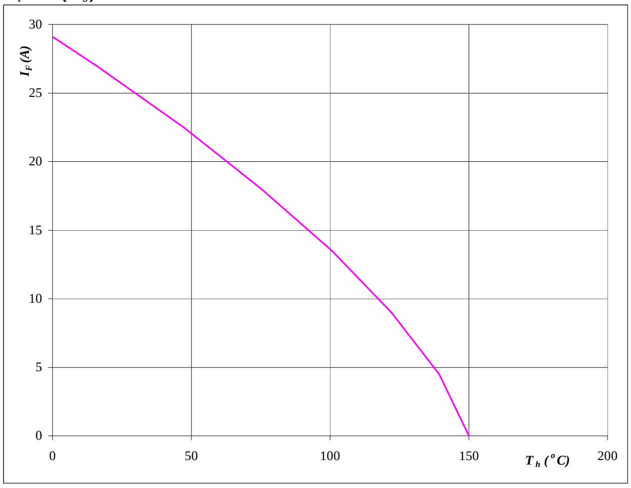
At

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

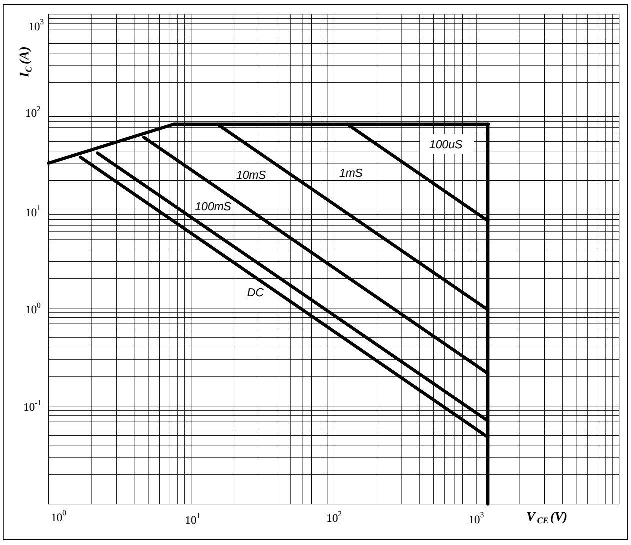
Half Bridge

Half Bridge IGBT & Neutral Point FWD

figure 25. **IGBT**

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



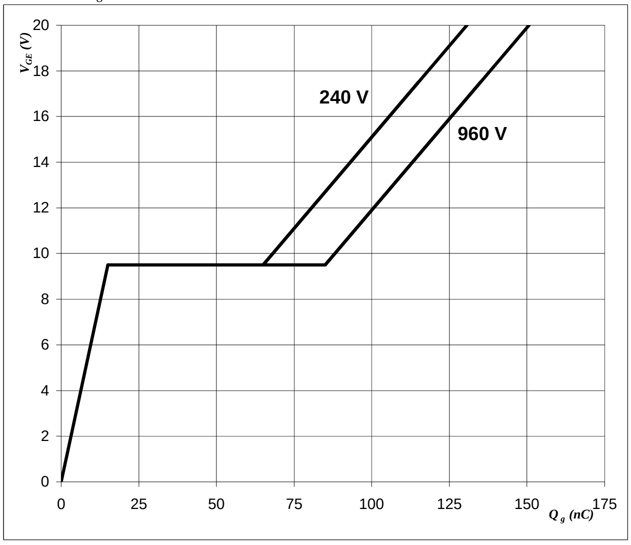
At

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_C =	0	A

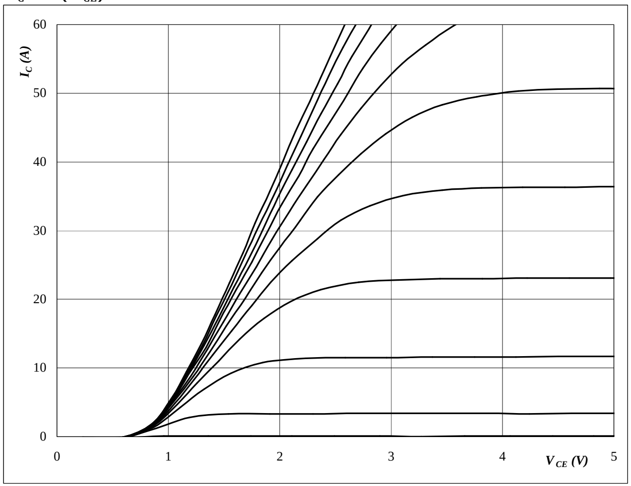
Neutral Point

Neutral Point IGBT & Half Bridge FWD

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



At

t_p = 250 µs

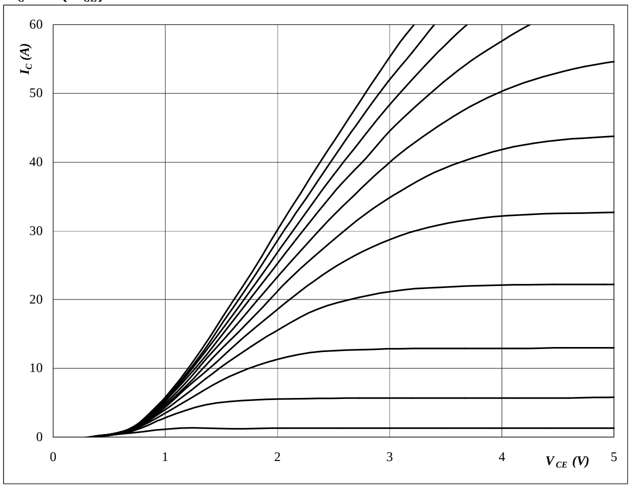
T_j = 25 °C

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

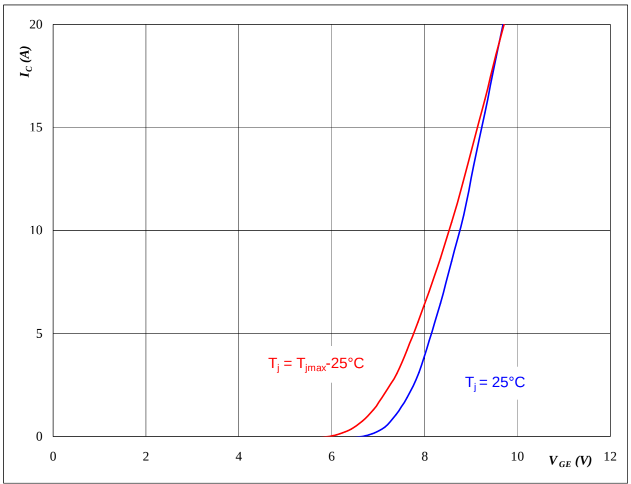
T_j = 126 °C

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

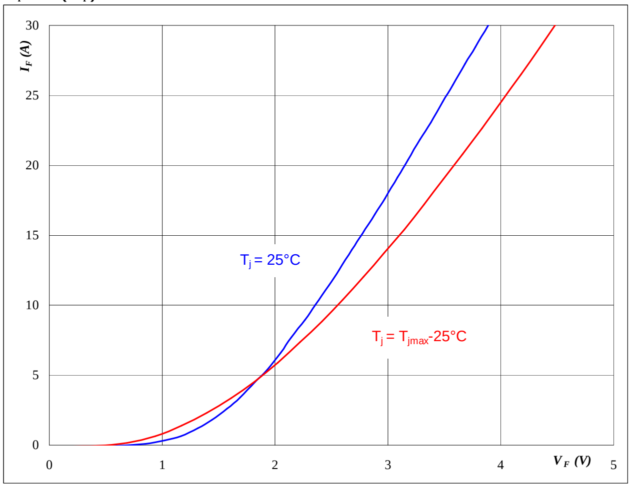
t_p = 250 µs

V_{CE} = 10 V

figure 4. **FWD**

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



At

t_p = 250 µs

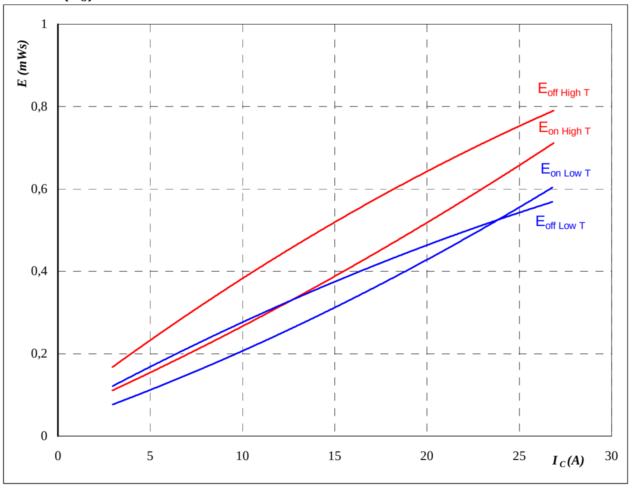
Neutral Point

Neutral Point IGBT & Half Bridge FWD

figure 5. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



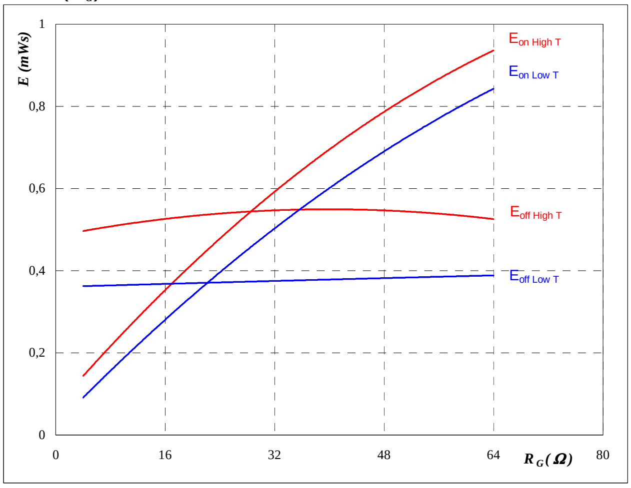
With an inductive load at

T_j =	25/126	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 6. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



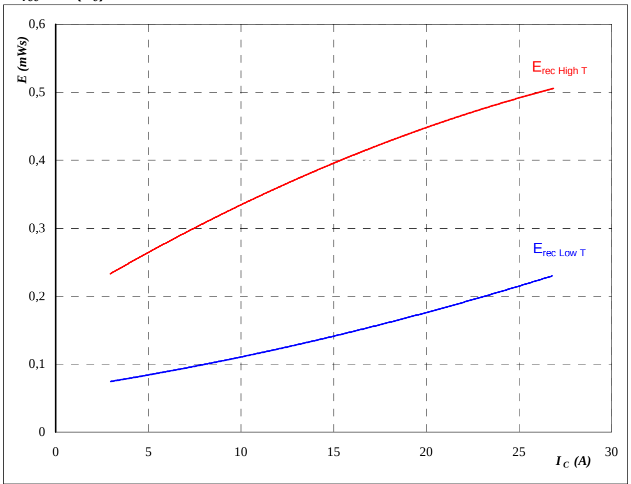
With an inductive load at

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

figure 7. **FWD**

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_c)$



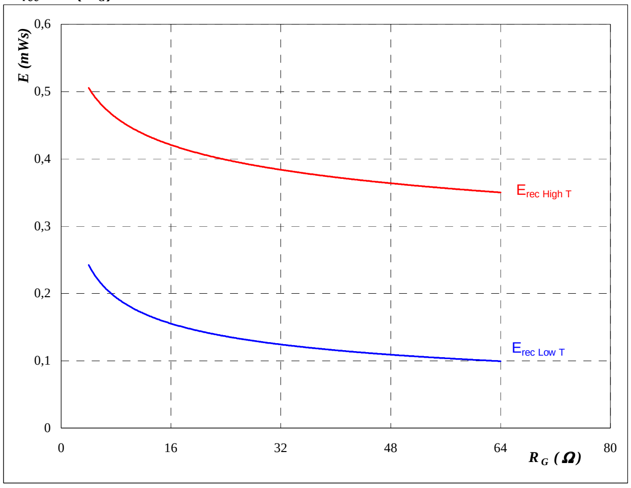
With an inductive load at

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

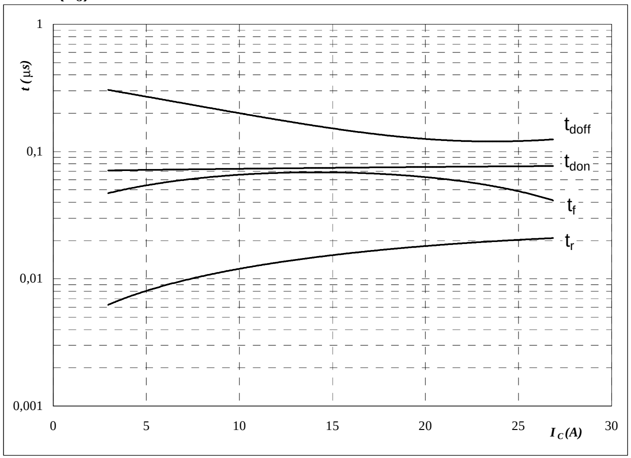
Neutral Point

Neutral Point IGBT & Half Bridge FWD

figure 9. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



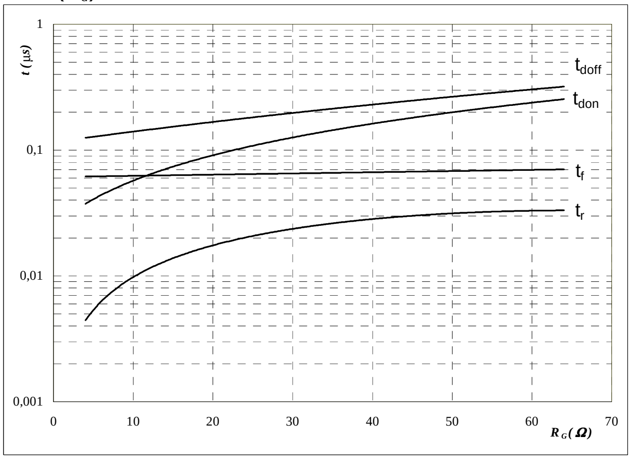
With an inductive load at

T_j =	126	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 10. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_G)$



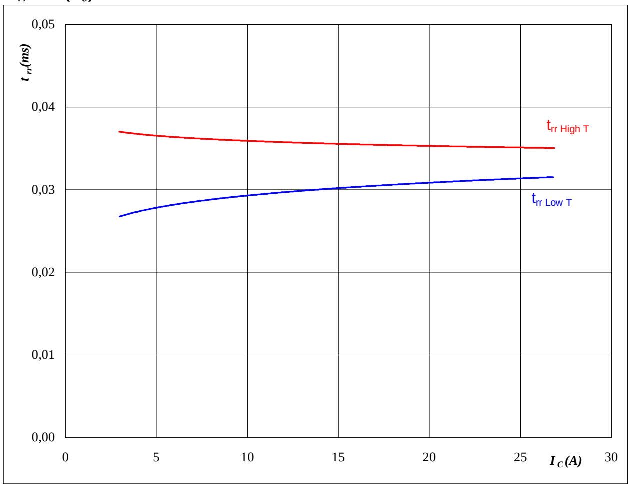
With an inductive load at

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

figure 11. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_c)$



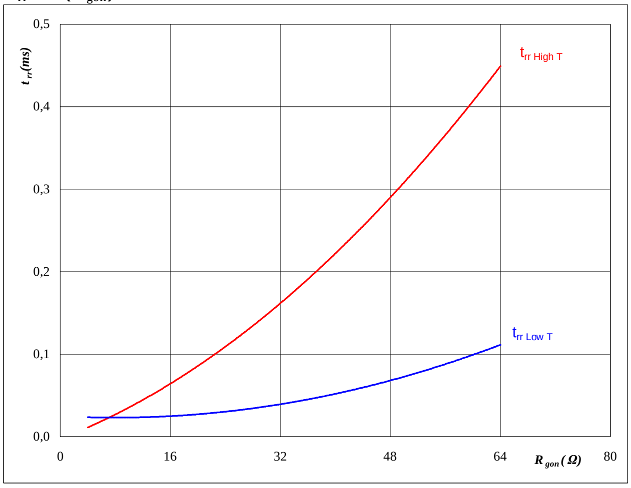
At

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

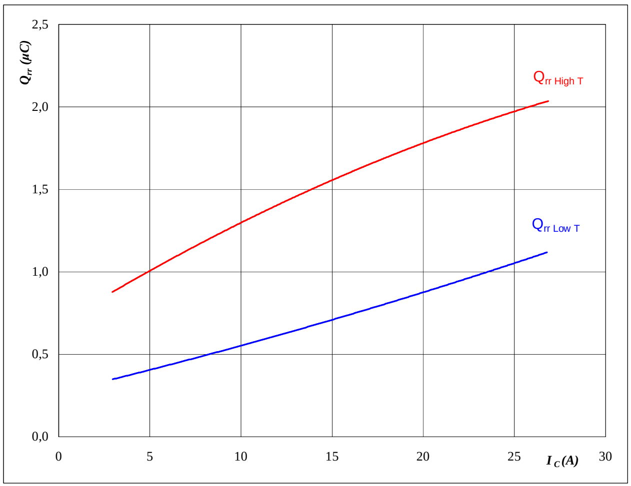
Neutral Point

Neutral Point IGBT & Half Bridge FWD

figure 13. **FWD**

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



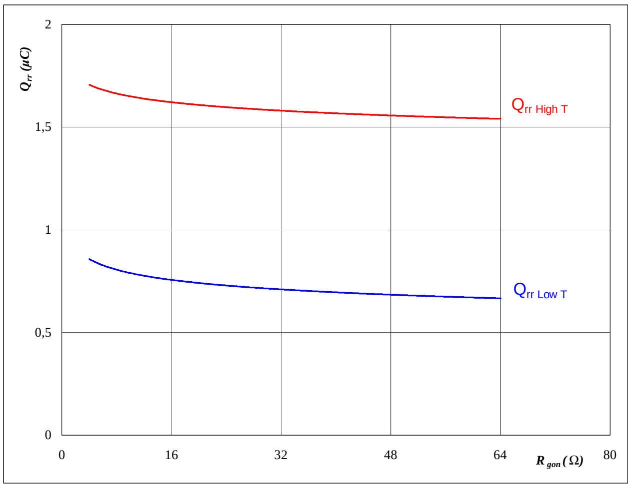
At

T_j =	25/126	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

figure 14. **FWD**

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

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



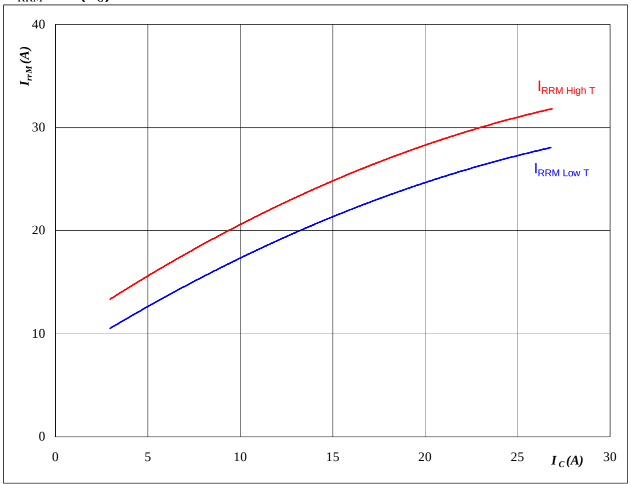
At

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

figure 15. **FWD**

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$



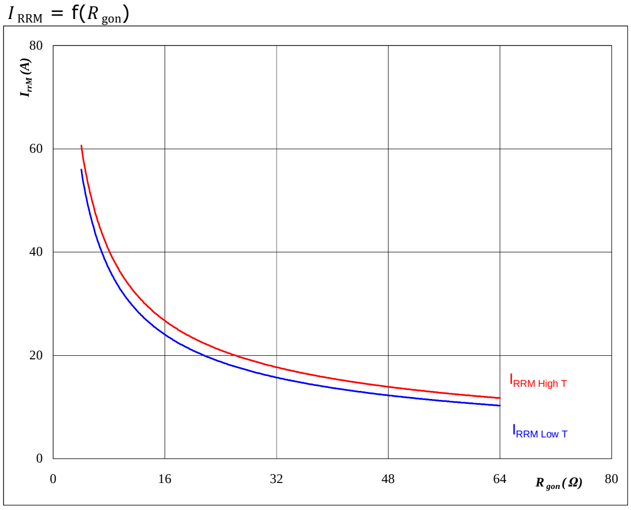
At

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

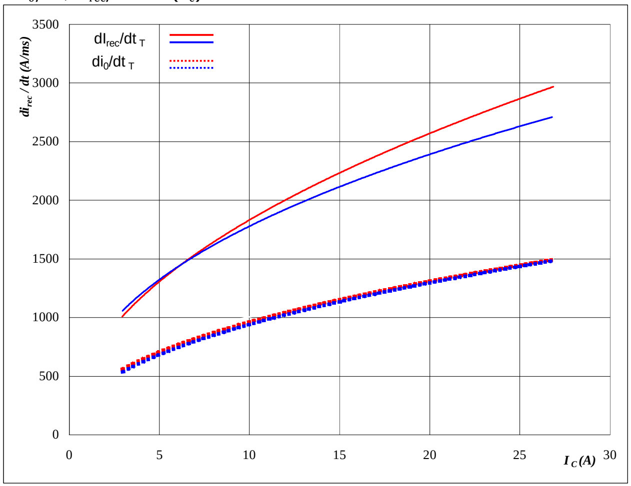
Neutral Point

Neutral Point IGBT & Half Bridge FWD

figure 17. **FWD**

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

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



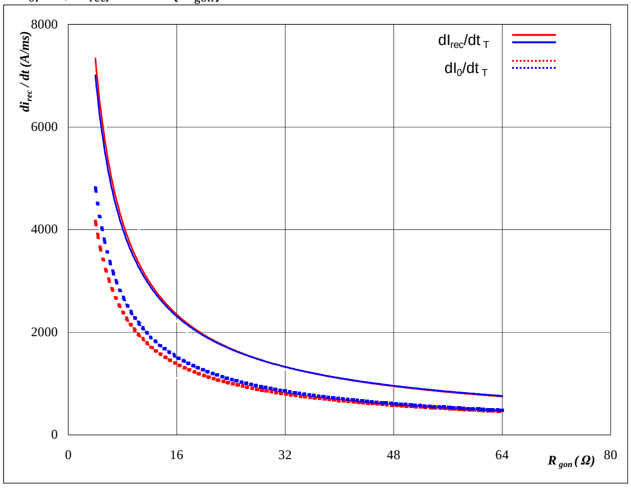
At

T_j =	25/126	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

figure 18. **FWD**

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

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



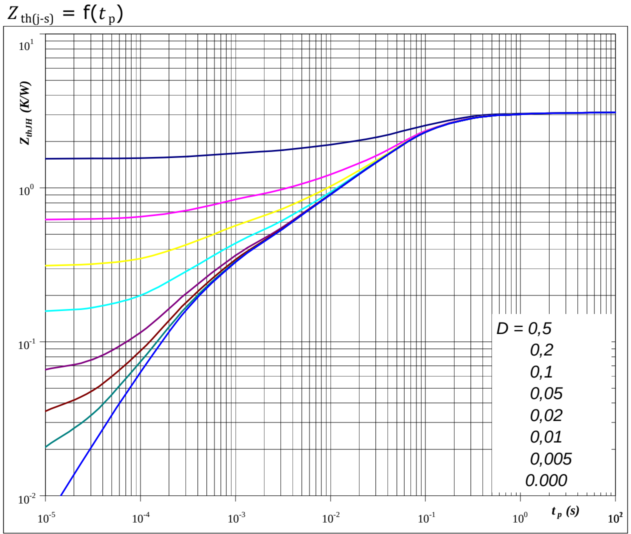
At

T_j =	25/126	°C
V_R =	350	V
I_F =	15	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	
$R_{th(j-s)}$ =	3,09	K/W

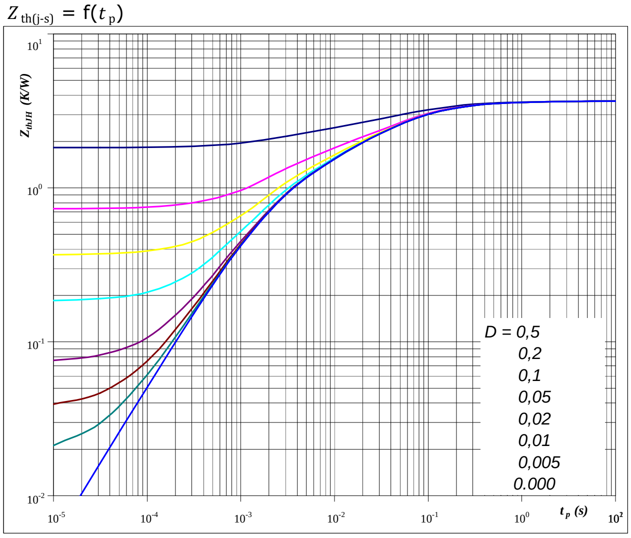
IGBT thermal model values

R (K/W)	Tau (s)
9,31E-02	1,78E+00
3,67E-01	2,71E-01
1,74E+00	6,94E-02
3,64E-01	1,36E-02
2,46E-01	3,45E-03
2,37E-01	4,12E-04

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	
$R_{th(j-s)}$ =	3,65	K/W

FWD thermal model values

R (K/W)	Tau (s)
1,54E-01	1,23E+00
5,83E-01	1,75E-01
1,42E+00	4,78E-02
7,75E-01	8,99E-03
7,22E-01	1,81E-03

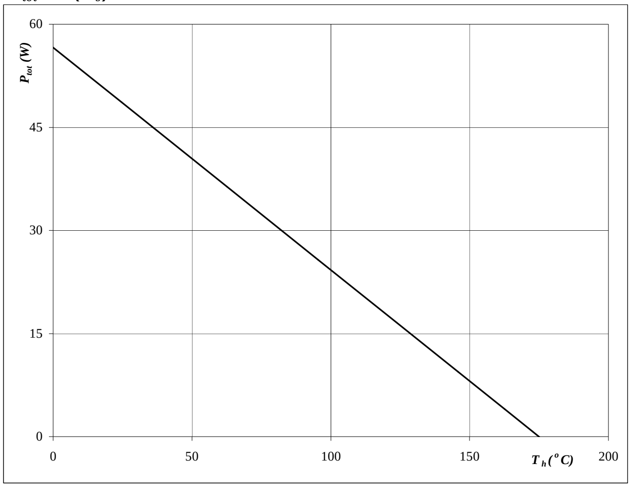
Neutral Point

Neutral Point IGBT & Half Bridge FWD

figure 21. **IGBT**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$

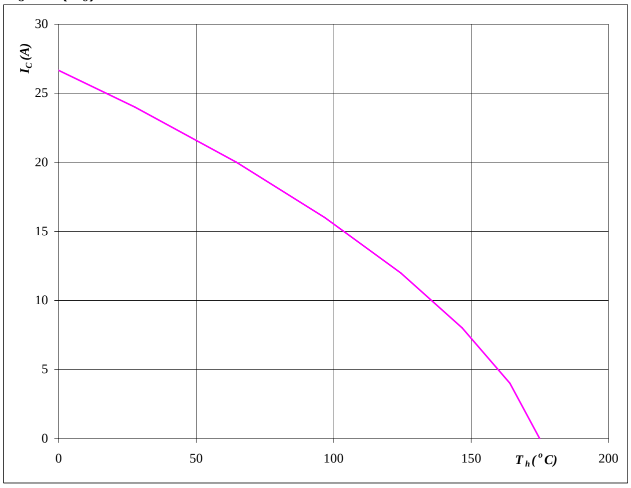


At
T_j = 175 ºC

figure 22. **IGBT**

Collector current as a function of heatsink temperature

$I_C = f(T_s)$

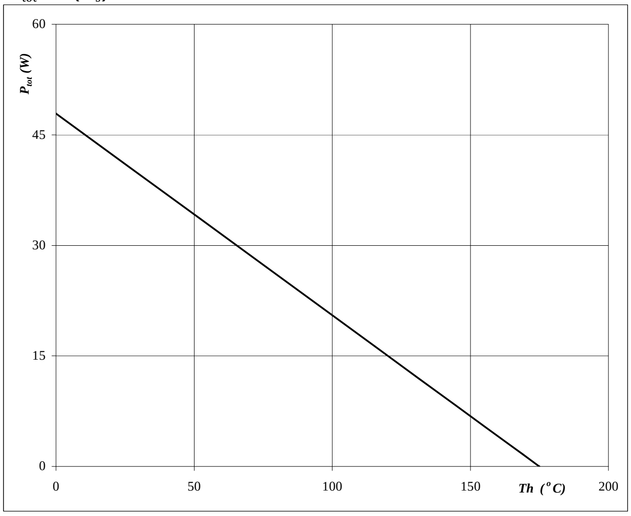


At
T_j = 175 ºC
V_{GE} = 15 V

figure 23. **FWD**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$

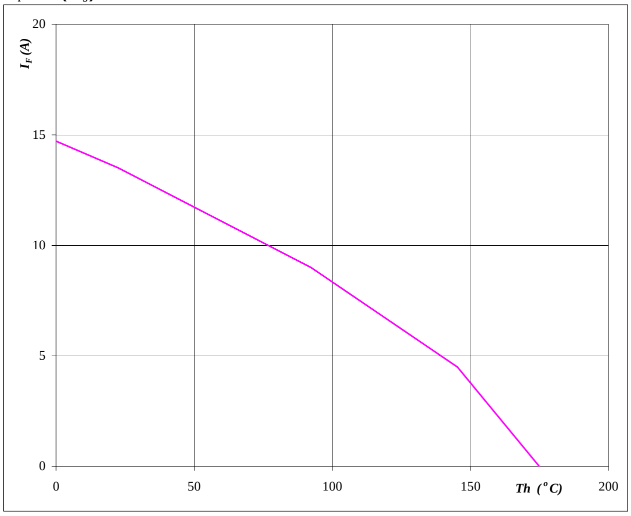


At
T_j = 175 ºC

figure 24. **FWD**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$

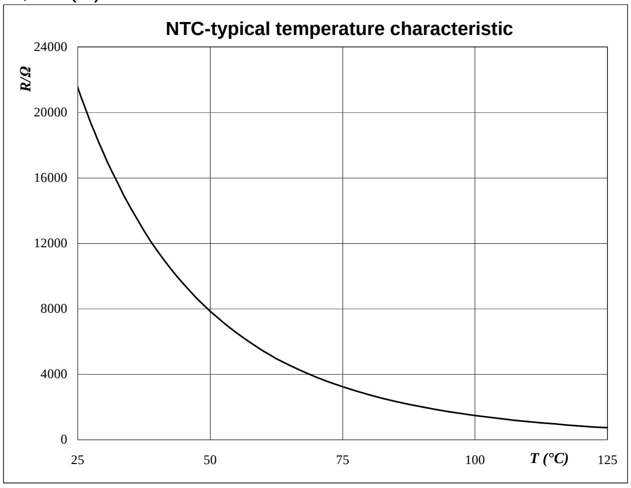


At
T_j = 175 ºC

Thermistor

figure 1.	Thermistor

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



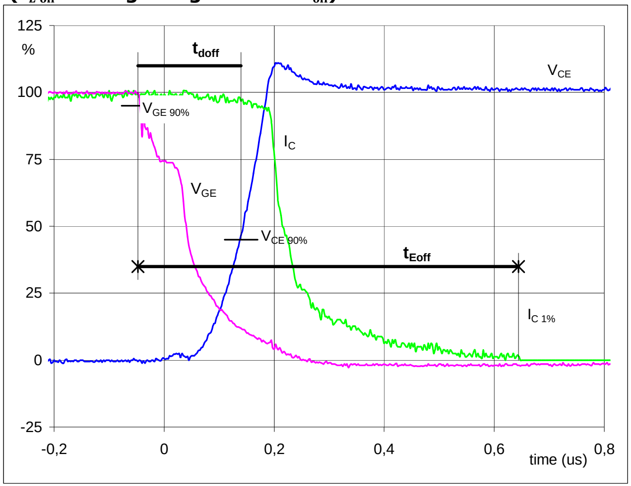
Switching Definitions Half Bridge

General conditions

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

figure 1. **IGBT**

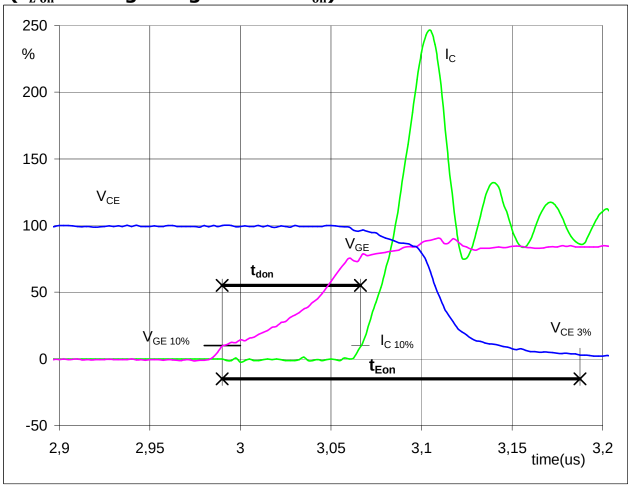
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	350	V
I_C (100%) =	15	A
t_{doff} =	0,22	µs
$t_{E\,off}$ =	0,69	µs

figure 2. **IGBT**

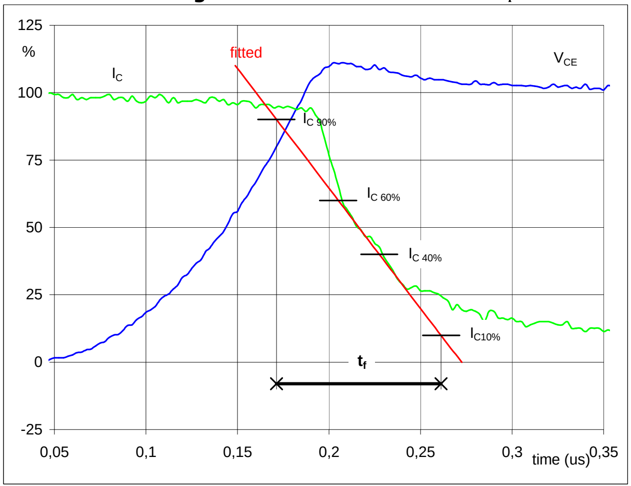
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	350	V
I_C (100%) =	15	A
t_{don} =	0,07	µs
$t_{E\,on}$ =	0,20	µs

figure 3. **IGBT**

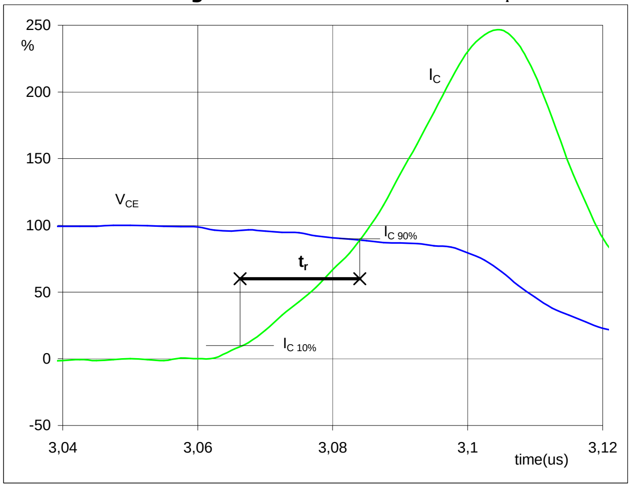
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	350	V
I_C (100%) =	15	A
t_f =	0,12	µs

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of t_r

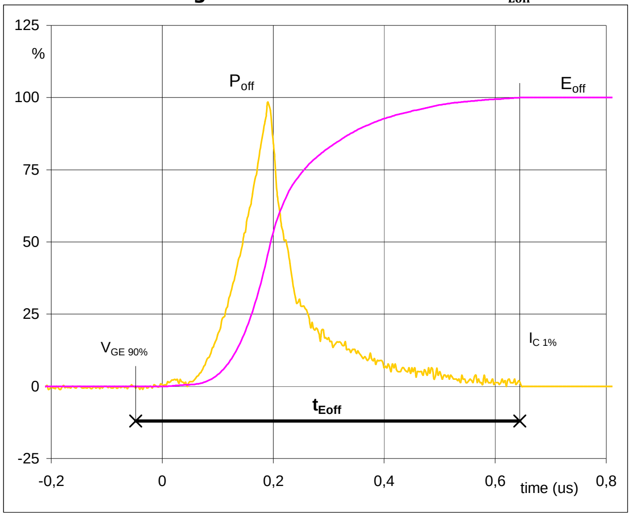


V_C (100%) =	350	V
I_C (100%) =	15	A
t_r =	0,02	µs

Switching Definitions Half Bridge

figure 5. **IGBT**

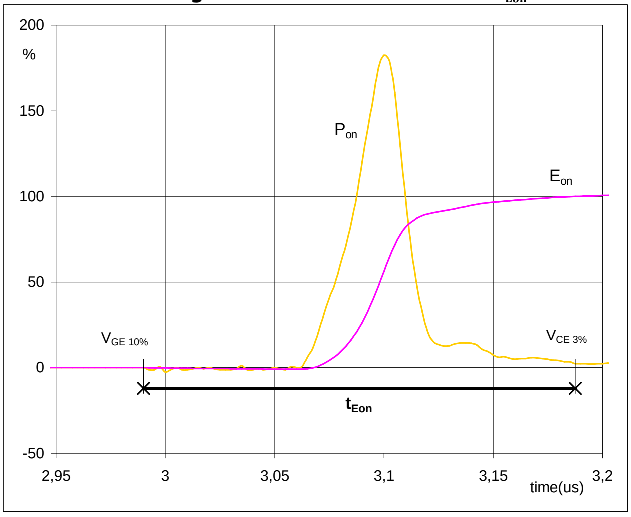
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	5,28	kW
E_{off} (100%) =	0,63	mJ
$t_{E\,off}$ =	0,69	μs

figure 6. **IGBT**

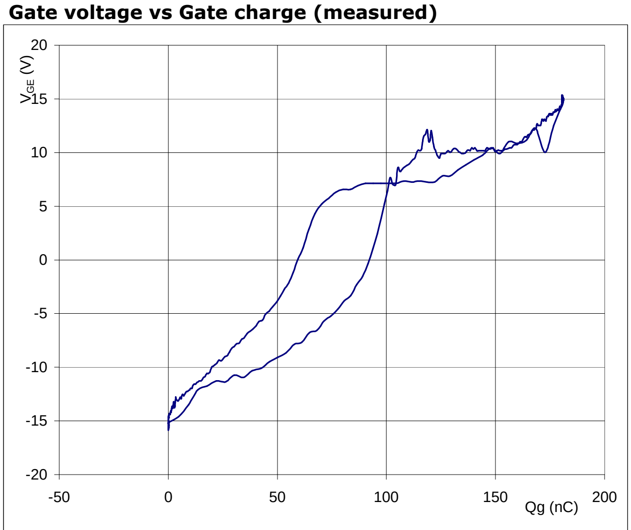
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	5,28	kW
E_{on} (100%) =	0,30	mJ
$t_{E\,on}$ =	0,20	μs

figure 7. **IGBT**

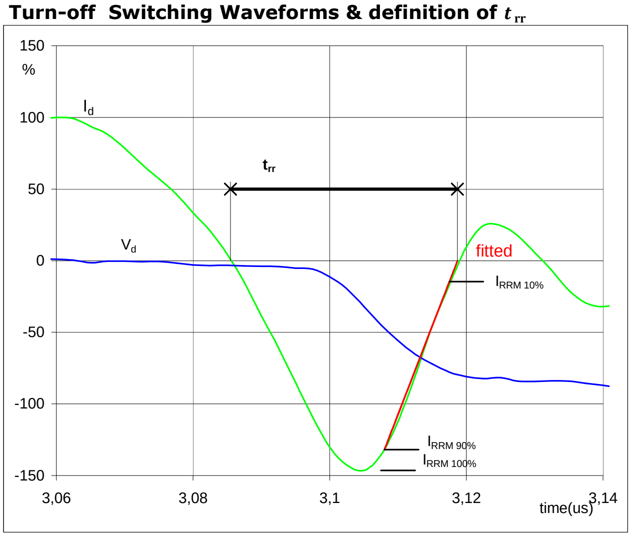
Gate voltage vs Gate charge (measured)



$V_{GE\,off}$ =	-15	V
$V_{GE\,on}$ =	15	V
V_C (100%) =	350	V
I_C (100%) =	15	A
Q_g =	180,95	nC

figure 8. **FWD**

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

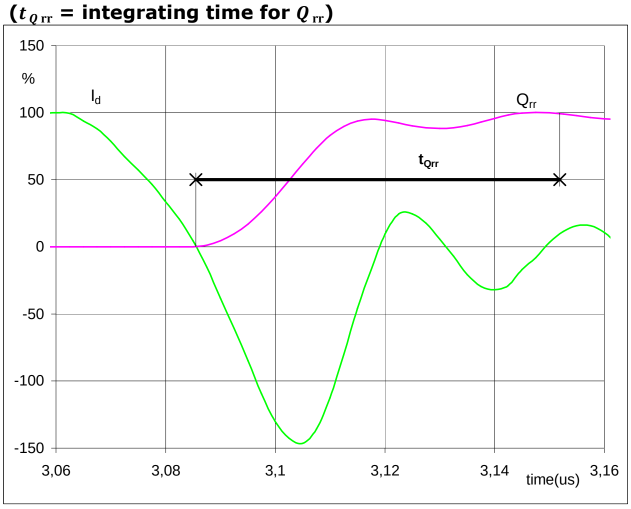


V_d (100%) =	350	V
I_d (100%) =	15	A
I_{RRM} (100%) =	-22	A
t_{rr} =	0,03	μs

Switching Definitions Half Bridge

figure 9. **IGBT**

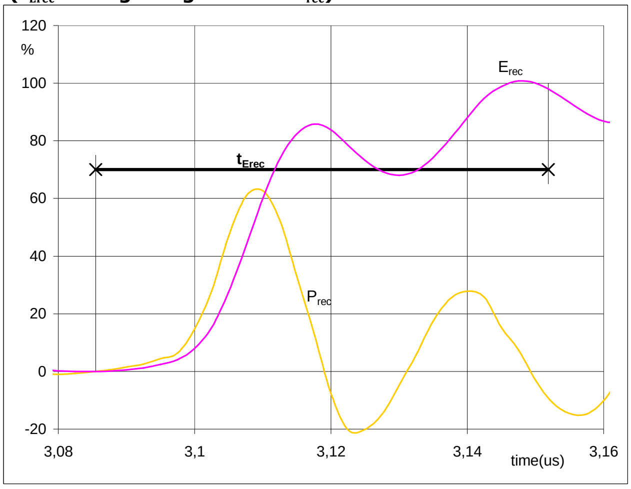
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q\,rr}$ = integrating time for Q_{rr})



I_d (100%) =	15	A
Q_{rr} (100%) =	0,44	μC
$t_{Q\,rr}$ =	0,07	μs

figure 10. **IGBT**

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

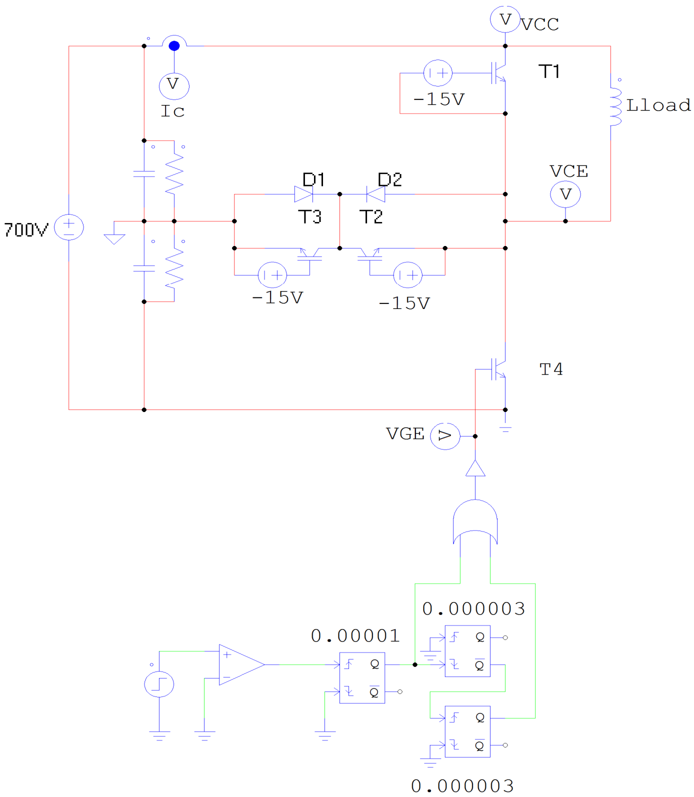


P_{rec} (100%) =	5,28	kW
E_{rec} (100%) =	0,05	mJ
$t_{E\,rec}$ =	0,07	μs

Half Bridge switching measurement circuit

figure 11.

Half Bridge stage switching measurement circuit



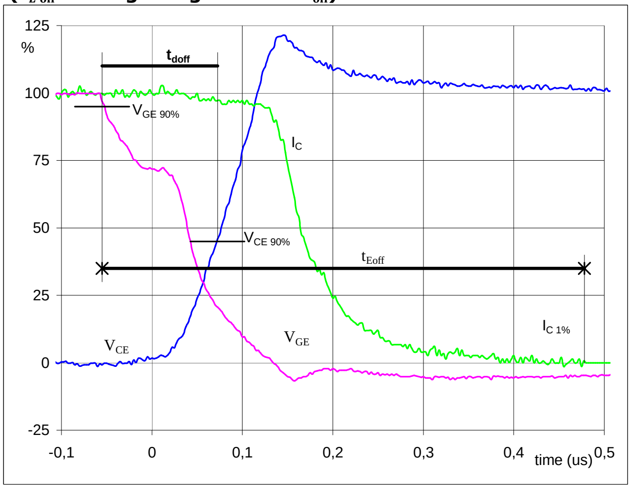
Switching Definitions Neutral Point

General conditions

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

figure 1. **Neutral Point IGBT**

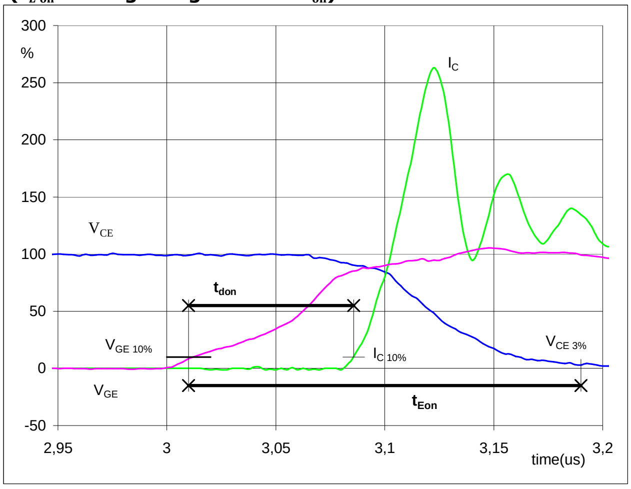
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	350	V
I_C (100%) =	15	A
t_{doff} =	0,16	µs
$t_{E\,off}$ =	0,53	µs

figure 2. **Neutral Point IGBT**

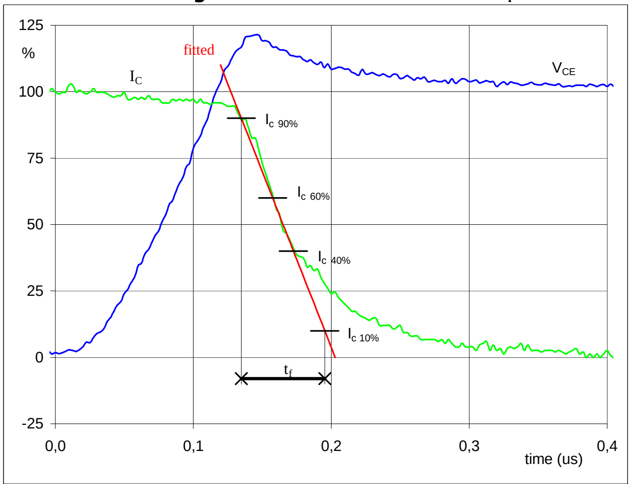
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	350	V
I_C (100%) =	15	A
t_{don} =	0,07	µs
$t_{E\,on}$ =	0,18	µs

figure 3. **Neutral Point IGBT**

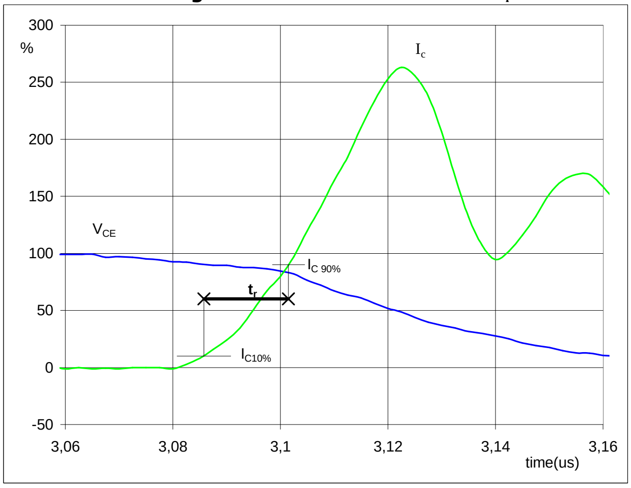
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	350	V
I_C (100%) =	15	A
t_f =	0,069	µs

figure 4. **Neutral Point IGBT**

Turn-on Switching Waveforms & definition of t_r

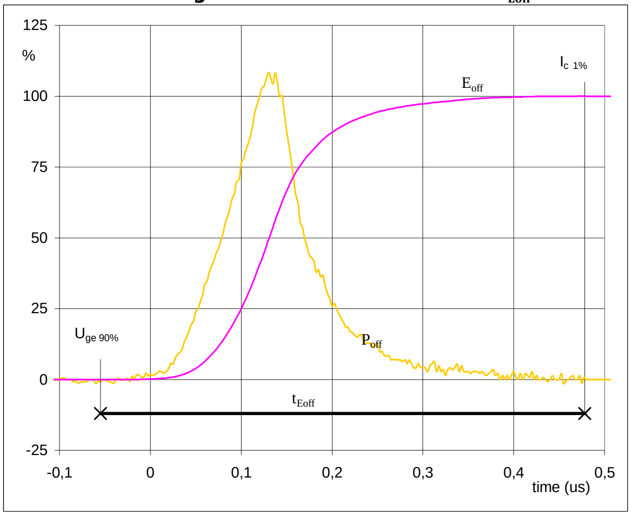


V_C (100%) =	350	V
I_C (100%) =	15	A
t_r =	0,016	µs

Switching Definitions Neutral Point

figure 5. **Neutral Point IGBT**

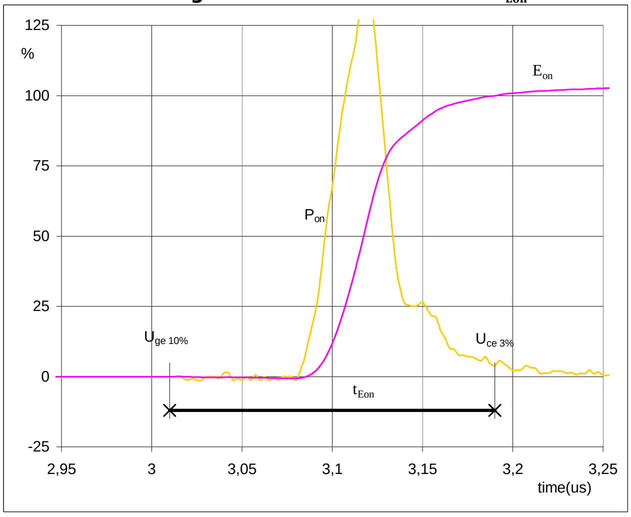
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	5,26	kW
E_{off} (100%) =	0,53	mJ
$t_{E\,off}$ =	0,53	μs

figure 6. **Neutral Point IGBT**

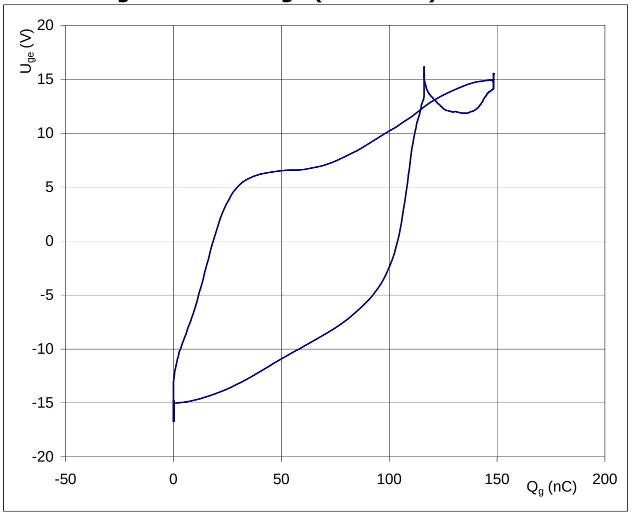
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	5,26	kW
E_{on} (100%) =	0,30	mJ
$t_{E\,on}$ =	0,18	μs

figure 7. **Neutral Point IGBT**

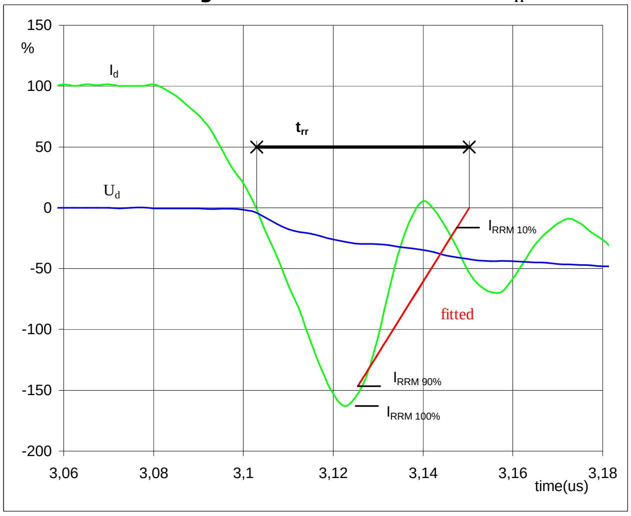
Gate voltage vs Gate charge (measured)



$V_{GE\,off}$ =	-15	V
$V_{GE\,on}$ =	15	V
V_C (100%) =	350	V
I_C (100%) =	15	A
Q_g =	148	nC

figure 8. **Half Bridge FWD**

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

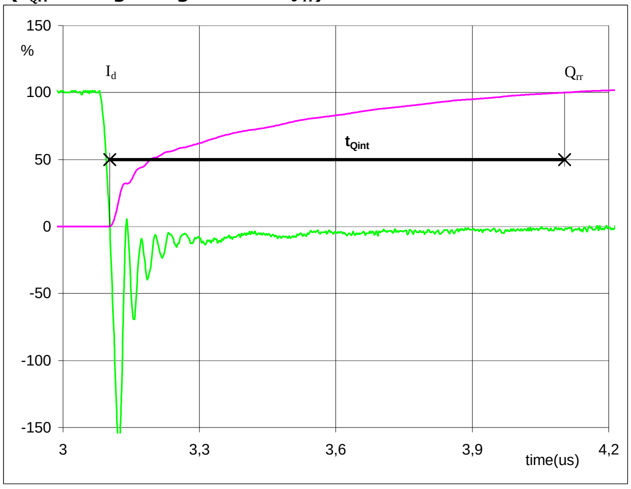


V_d (100%) =	350	V
I_d (100%) =	15	A
I_{RRM} (100%) =	-24	A
t_{rr} =	0,04	μs

Switching Definitions Neutral Point

figure 9. **Half Bridge FWD**

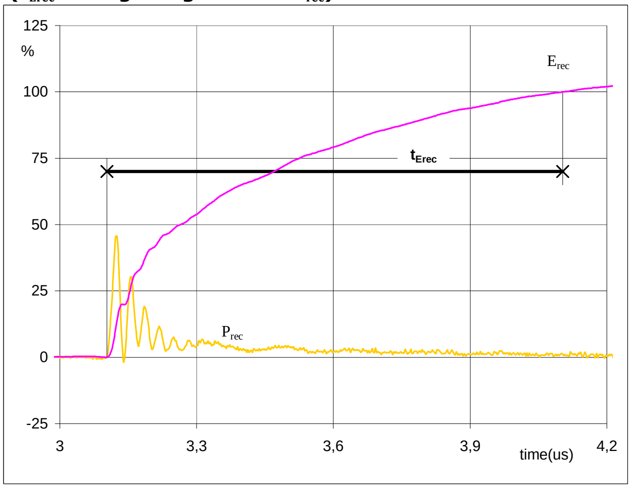
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr}= integrating time for Q_{rr})



I_d (100%) =	15	A
Q_{rr} (100%) =	1,51	μC
t_{Qint} =	1,00	μs

figure 10. **Half Bridge FWD**

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

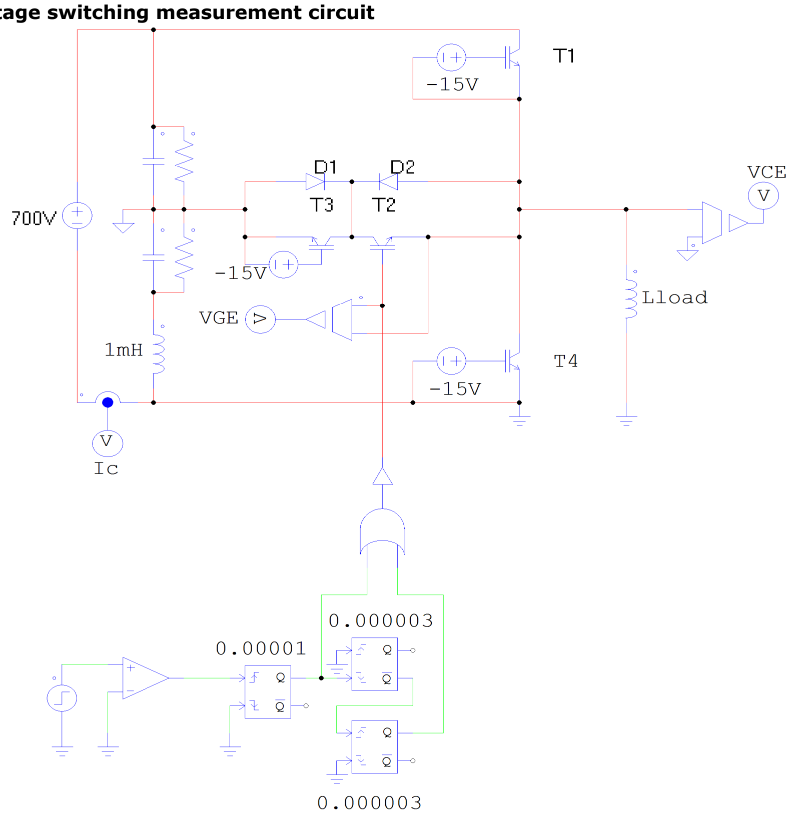


P_{rec} (100%) =	5,26	kW
E_{rec} (100%) =	0,38	mJ
$t_{E\,rec}$ =	1,00	μs

Neutral Point switching measurement circuit

figure 11.

Neutral Point stage switching measurement circuit



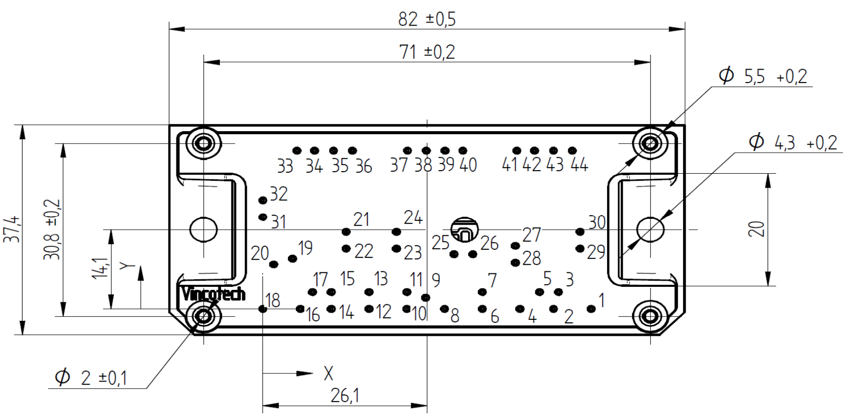
Ordering Code and Marking - Outline - Pinout

Ordering Code & Marking

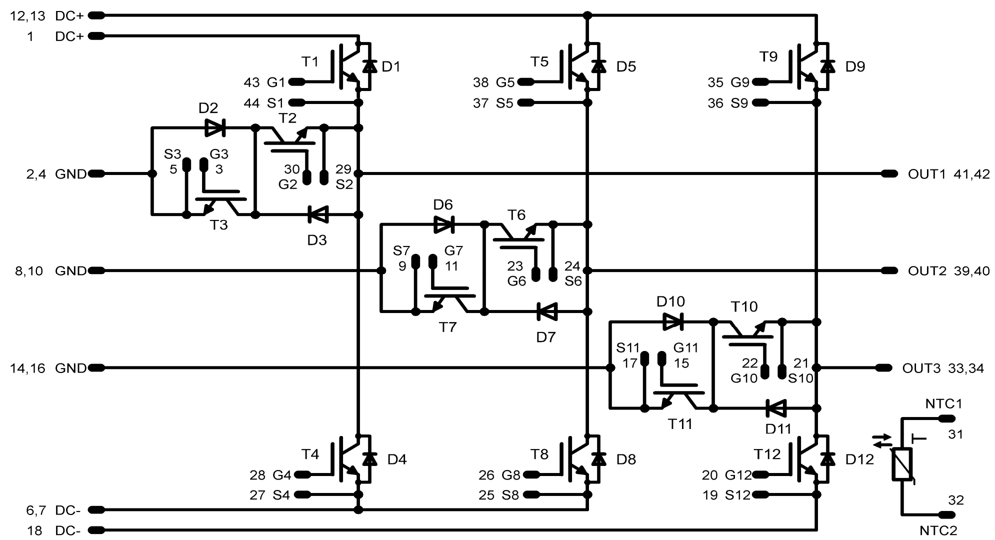
Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 12mm housing	10-FY12M3A025SH-M746F08	M746F08	M746F08
without thermal paste 17mm housing	10-F112M3A025SH-M746F09	M746F09	M746F09

Outline

Pin	X	Y	Pin	X	Y
1	52,2	0	23	21,25	10,7
2	46,2	0	24	21,25	13,7
3	47	3	25	30,4	9,7
4	40,9	0	26	33,4	9,7
5	44	3	27	40,15	11,2
6	34,9	0	28	40,15	8,2
7	34,9	3	29	50,45	10,7
8	28,9	0	30	50,45	13,7
9	25,9	2	31	0	16,35
10	22,9	0	32	0	19,35
11	22,9	3	33	5,45	28,2
12	16,9	0	34	8,25	28,2
13	16,9	3	35	11,25	28,2
14	10,9	0	36	14,25	28,2
15	10,9	3	37	23	28,2
16	6	0	38	26	28,2
17	7,9	3	39	29	28,2
18	0	0	40	31,8	28,2
19	4,75	8,9	41	40,4	28,2
20	1,75	7,9	42	43,2	28,2
21	13,25	13,7	43	46,2	28,2
22	13,25	10,7	44	49,2	28,2



Pinout



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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.