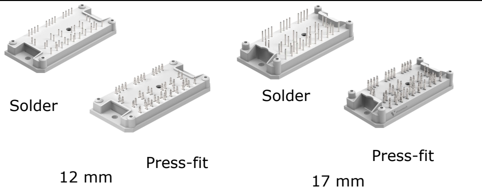
***flow* 3xMNPC 1** **1200 V / 25 A**

Features

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

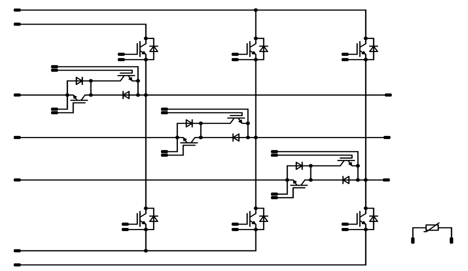
flow 1 housing



Target Applications

- solar inverter
- UPS

Schematic



Types

- 10-FY12M3A025SH-M746F08
- 10-P112M3A025SH-M746F08Y
- 10-F112M3A025SH-M746F09
- 10-P112M3A025SH-M746F09Y

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Half Bridge IGBT					
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					
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					
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		$T_j \leq$ 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}	$T_j \leq$ 150 °C V_{GE} = 15 V		6 360	µs V
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	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	6000	V
		t = 1 min	AC Voltage	2500	V
Creepage distance				min 12,7	mm
Clearance		12 mm Solder pin		8,19	mm
		12 mm Press-fit pin		7,89	mm
		17 mm Solder pin		min 12,7	mm
		17 mm Press-fit pin		12,65	mm

* 100 % tested in production

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]	Value Min	Typ	Max	Unit
Half Bridge IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00085	25	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			0,0024	mA
Gate-emitter leakage current	I_{GES}		20	0		25			120	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		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										
Diode forward voltage	V_F				15	25 125		2,47 1,73	2,6	V
Reverse leakage current	I_r			600		25			10	μA
Peak reverse recovery current	I_{RRM}	R_{gon} = 16 Ω	±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					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 P. IGBT										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0012	25	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			0,0011	mA
Gate-emitter leakage current	I_{GES}		20	0		25			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 λ = 1 W/mK						3,09		K/W
Half Bridge FWD										
Diode forward voltage	V_F				8	25 125		2,18 2,30	2,65	V
Reverse leakage current	I_r			1200		25			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	

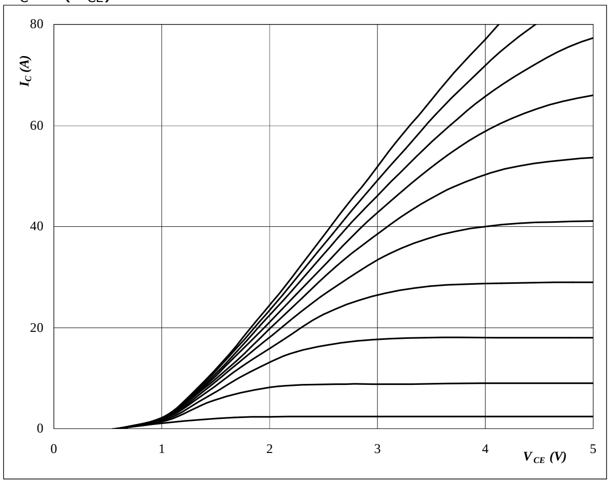
Half Bridge

Half Bridge IGBT & Neutral Point FWD

figure 1.	**IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



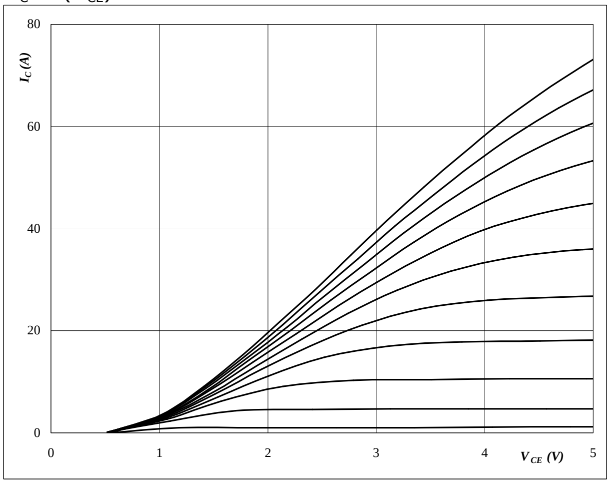
At

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

$I_C = f(V_{CE})$



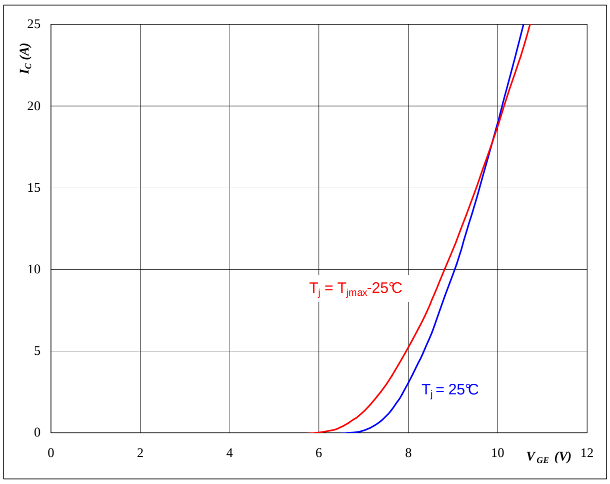
At

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

$I_C = f(V_{GE})$



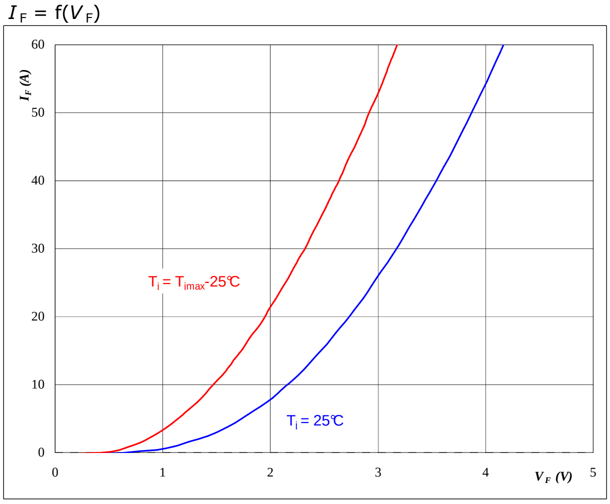
At

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

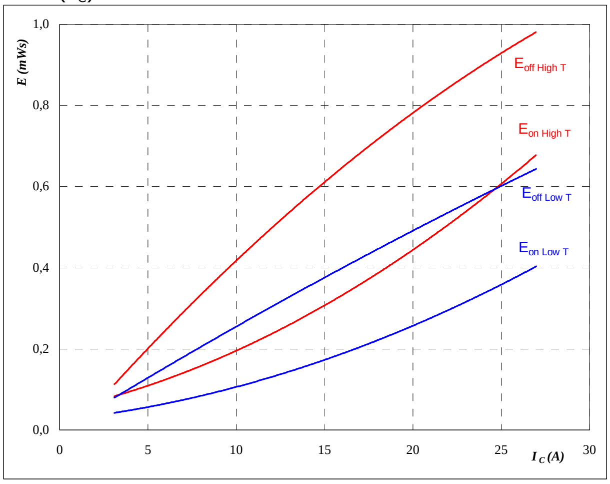
Half Bridge

Half Bridge IGBT & Neutral Point FWD

figure 5. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



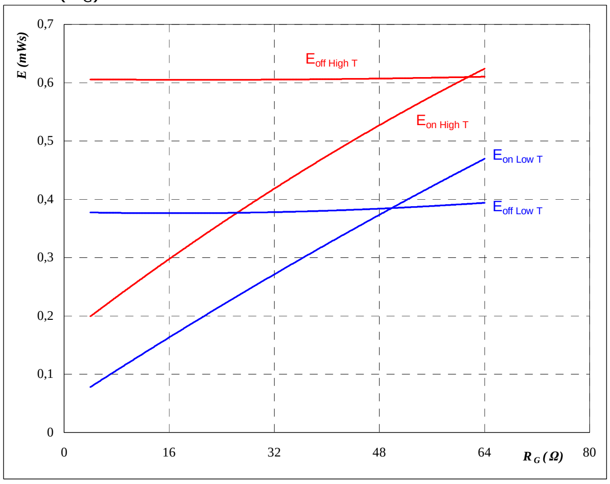
With an inductive load at

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

$E = f(R_G)$



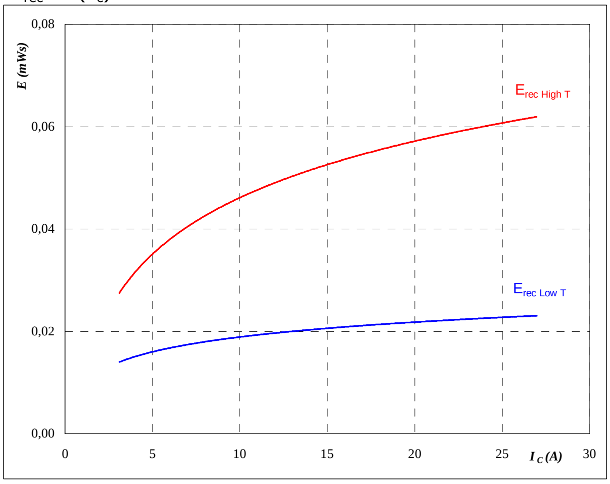
With an inductive load at

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

$E_{rec} = f(I_c)$



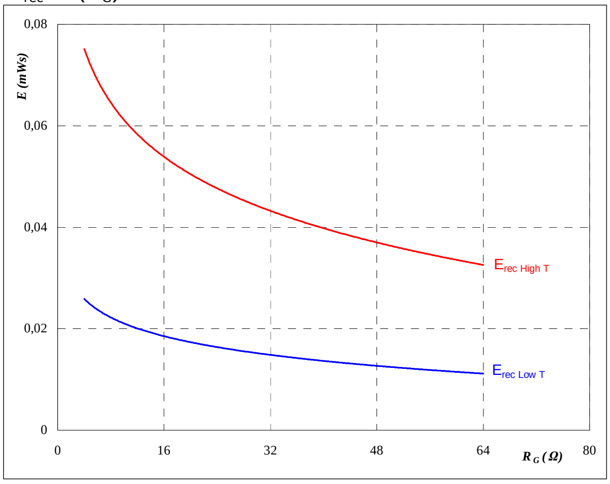
With an inductive load at

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

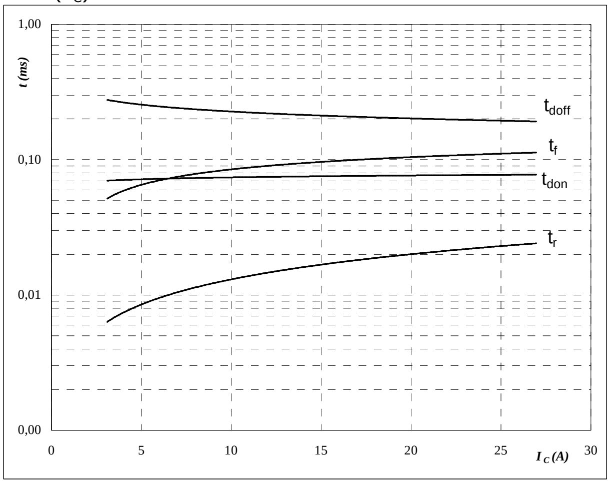
Half Bridge

Half Bridge IGBT & Neutral Point FWD

figure 9. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



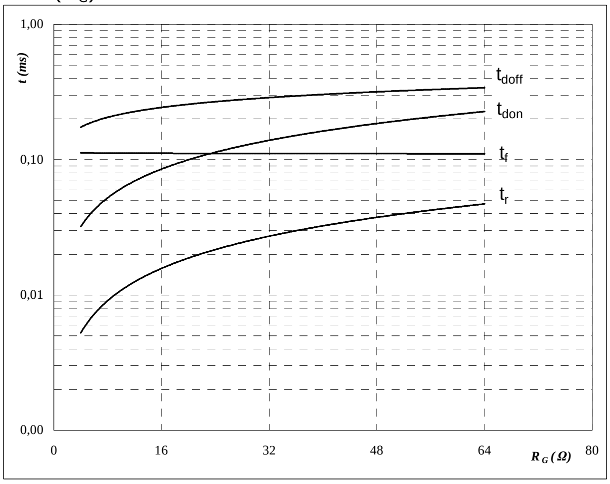
With an inductive load at

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

$t = f(R_G)$



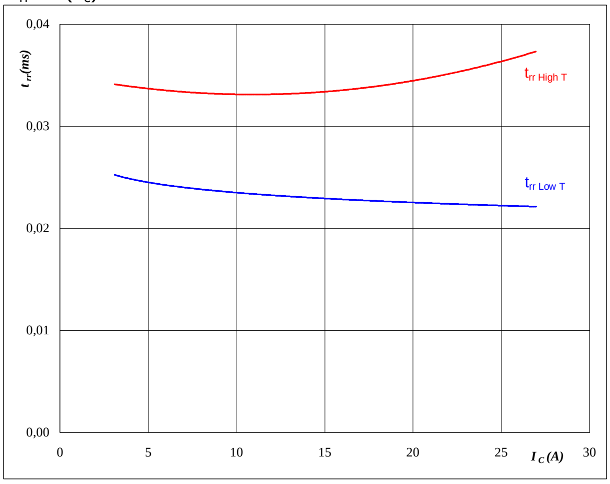
With an inductive load at

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

$t_{rr} = f(I_c)$



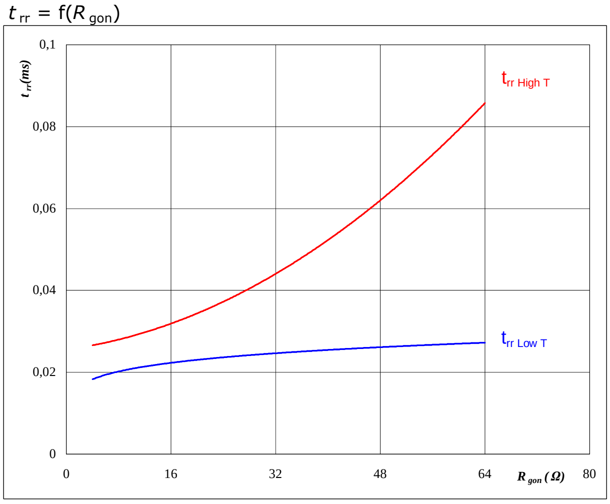
At

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

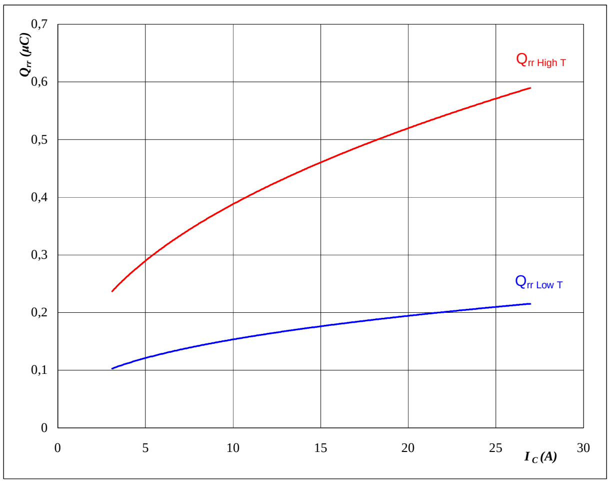
Half Bridge

Half Bridge IGBT & Neutral Point FWD

figure 13. **FWD**

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



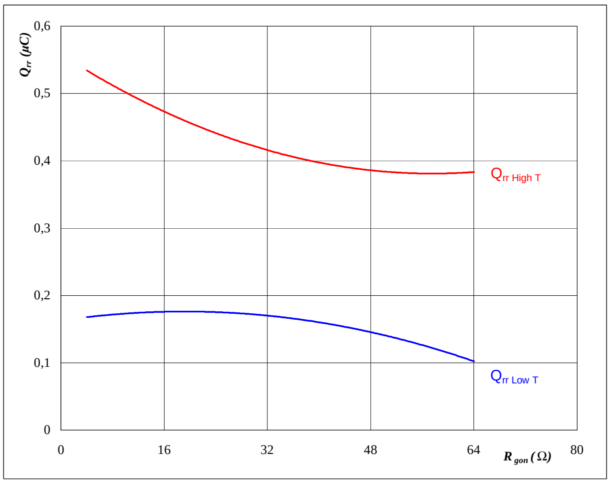
At

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

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



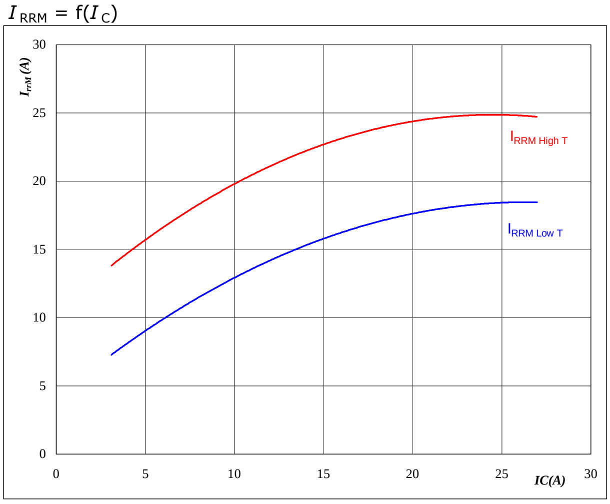
At

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

$I_{RRM} = f(I_C)$



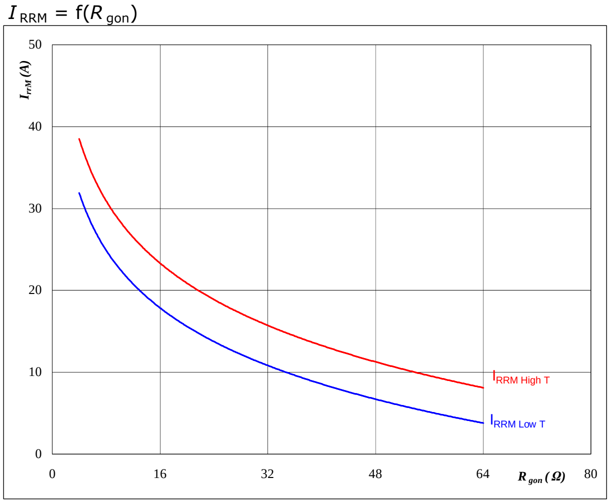
At

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

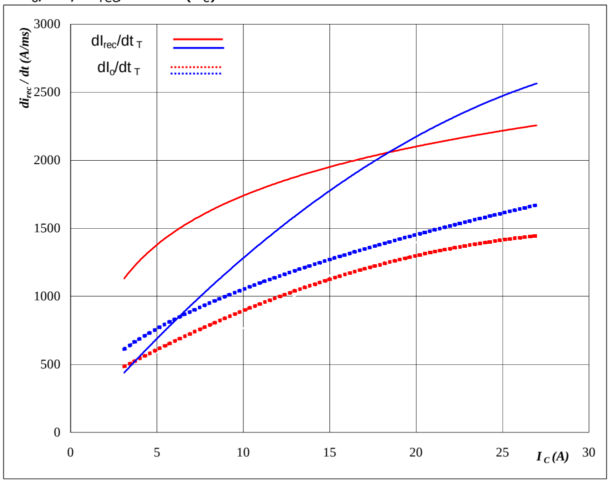
Half Bridge

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

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



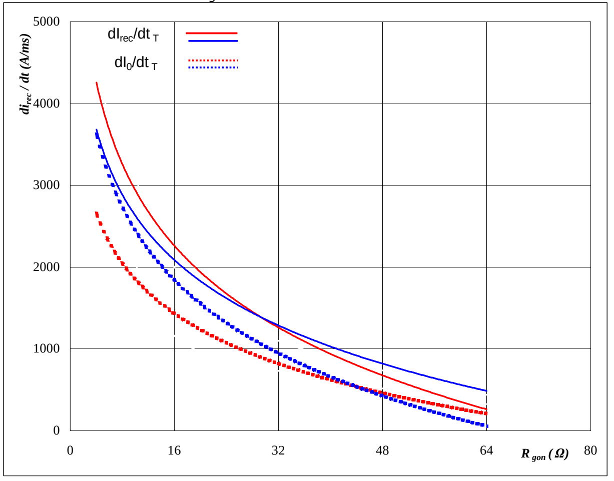
At

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

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



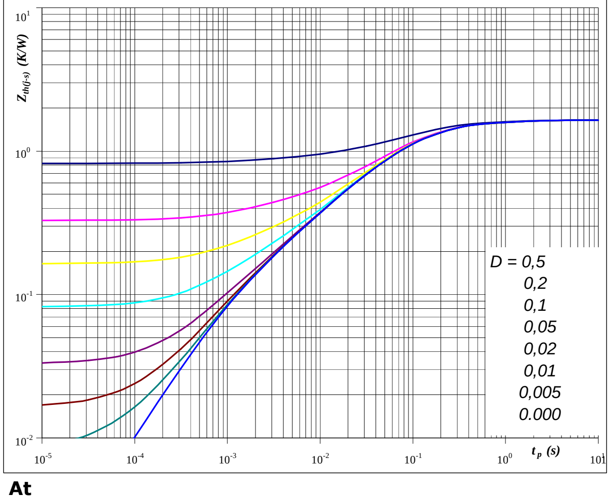
At

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

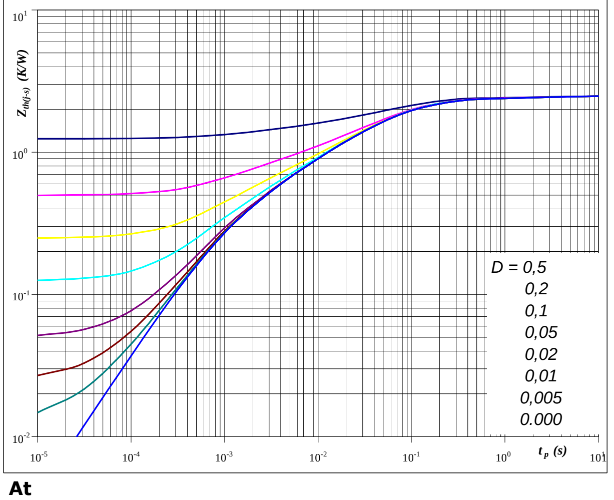
IGBT thermal model values

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

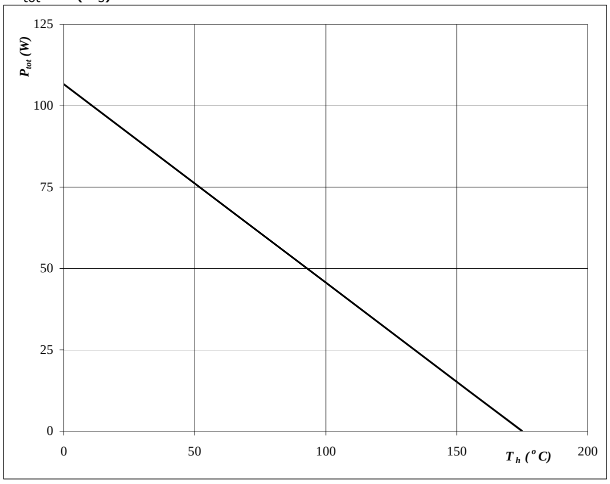
Half Bridge

Half Bridge IGBT & Neutral Point FWD

figure 21. **IGBT**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



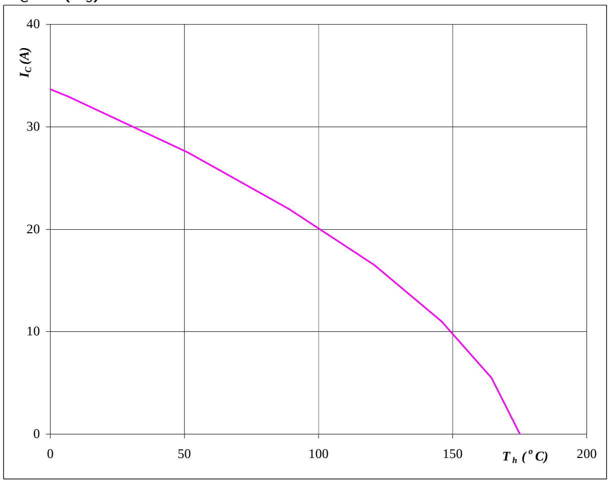
At

T_j = 175 °C

figure 22. **IGBT**

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

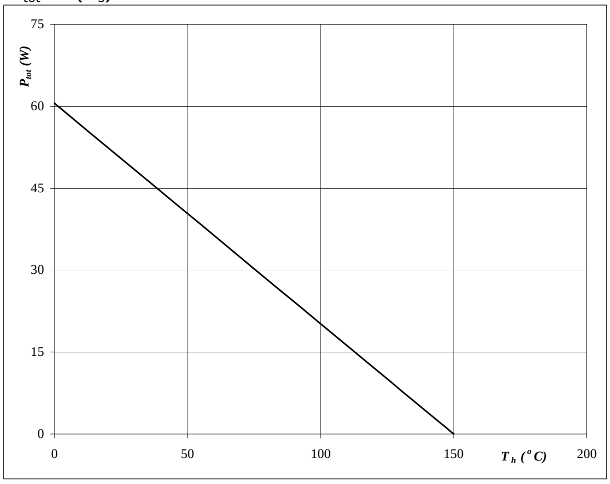
T_j = 175 °C

V_{GE} = 15 V

figure 23. **FWD**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



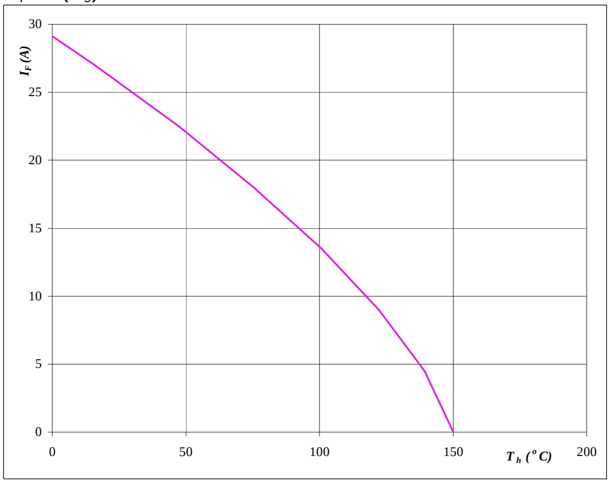
At

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

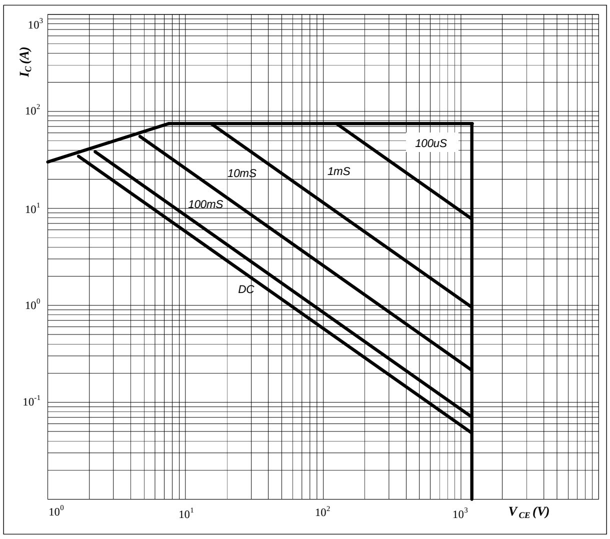
Half Bridge

Half Bridge IGBT & Neutral Point FWD

figure 25.	IGBT

Safe operating area as a function of collector-emitter voltage

$I_C = f(V_{CE})$



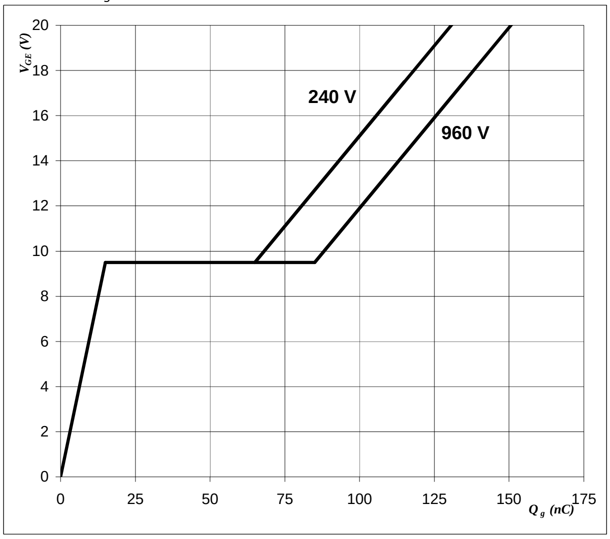
At

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

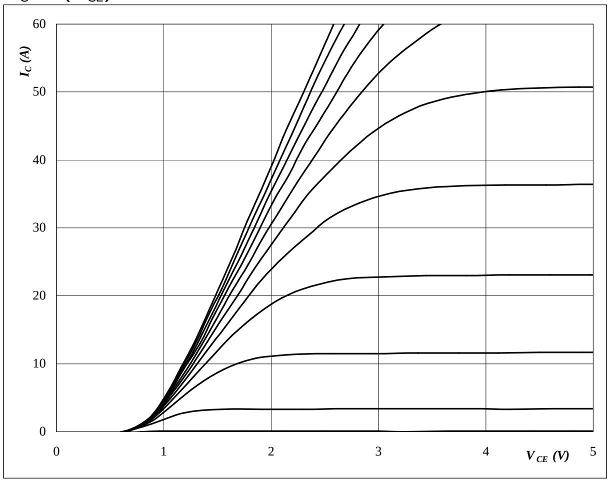
Neutral Point

Neutral Point IGBT & Half Bridge FWD

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



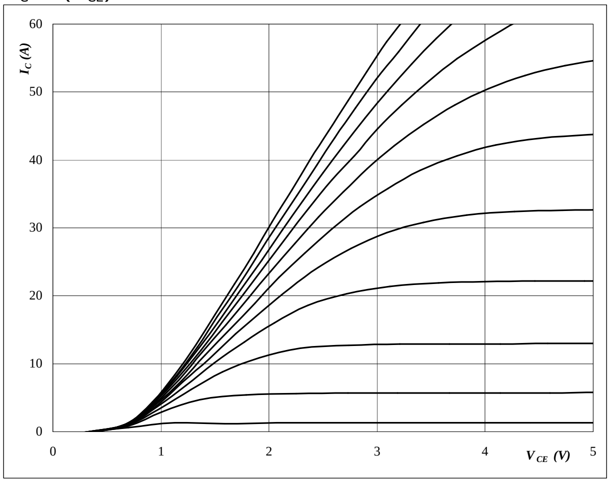
At

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

$I_C = f(V_{CE})$



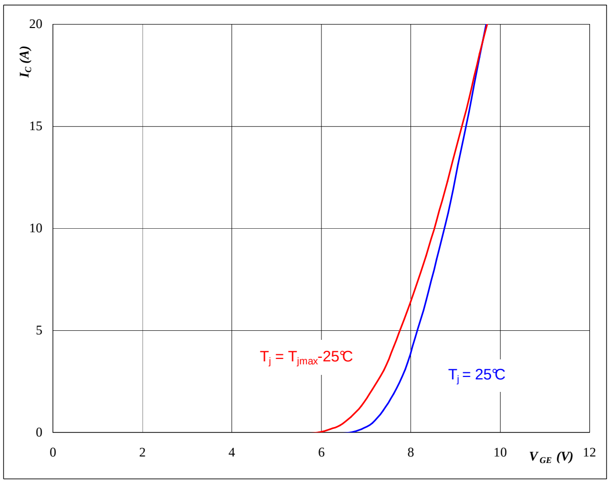
At

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

$I_C = f(V_{GE})$



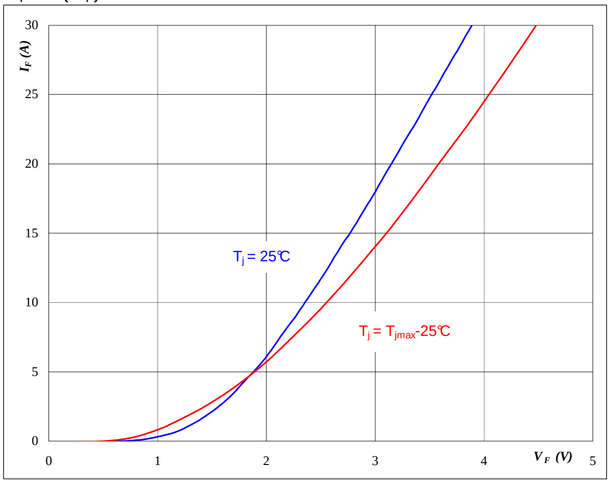
At

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

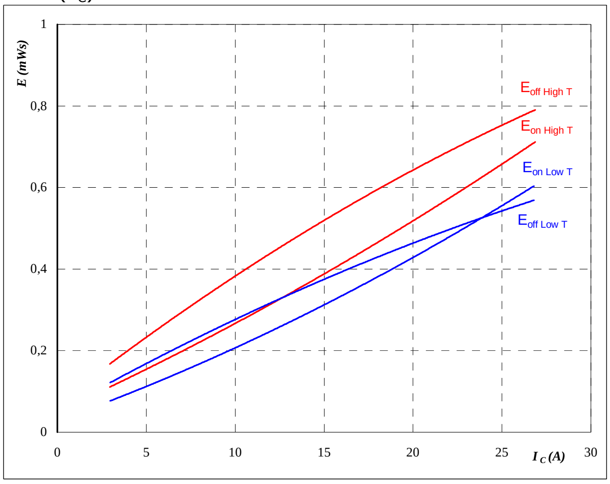
Neutral Point

Neutral Point IGBT & Half Bridge FWD

figure 5. **IGBT**

Typical switching energy losses
as a function of collector current

E = f(I_C)



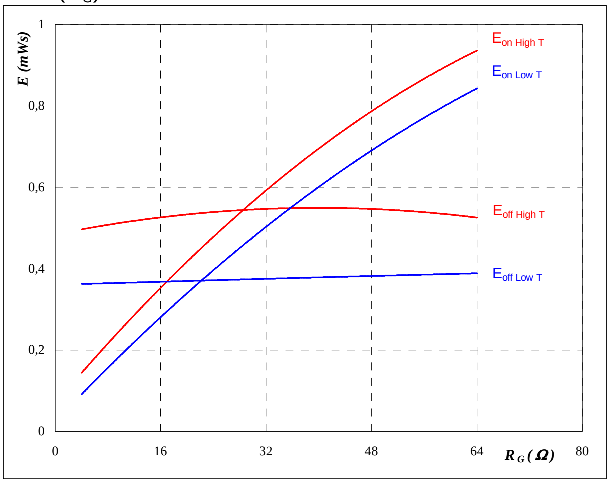
With an inductive load at

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)



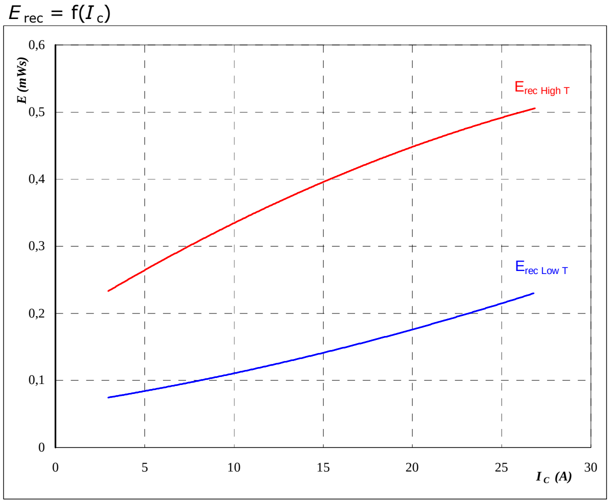
With an inductive load at

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)



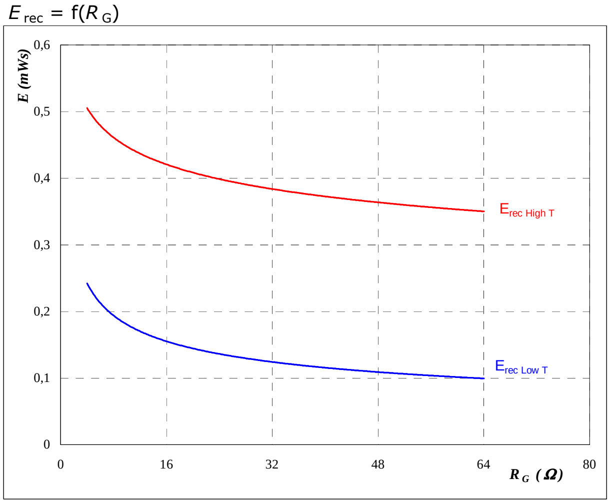
With an inductive load at

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

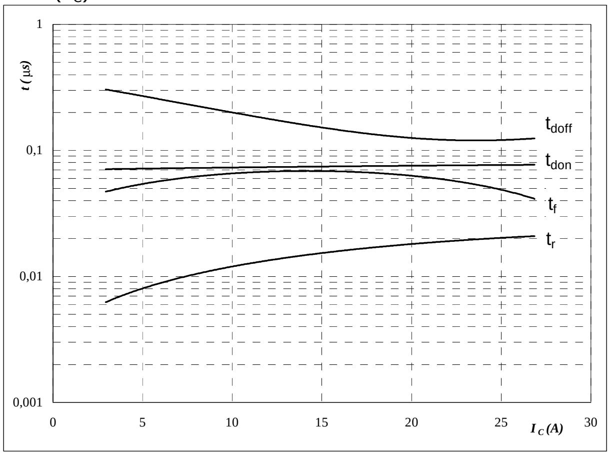
Neutral Point

Neutral Point IGBT & Half Bridge FWD

figure 9. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



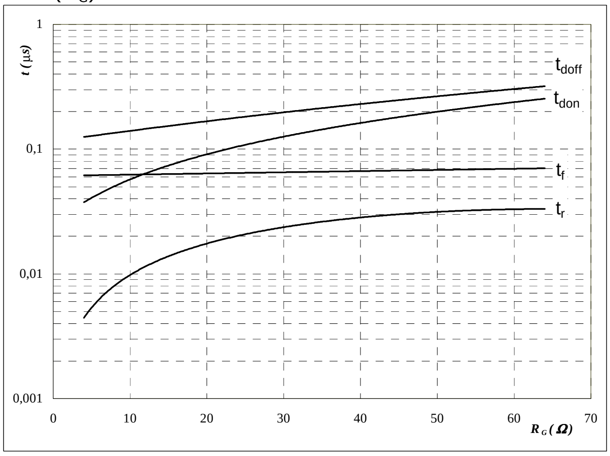
With an inductive load at

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

$t = f(R_G)$



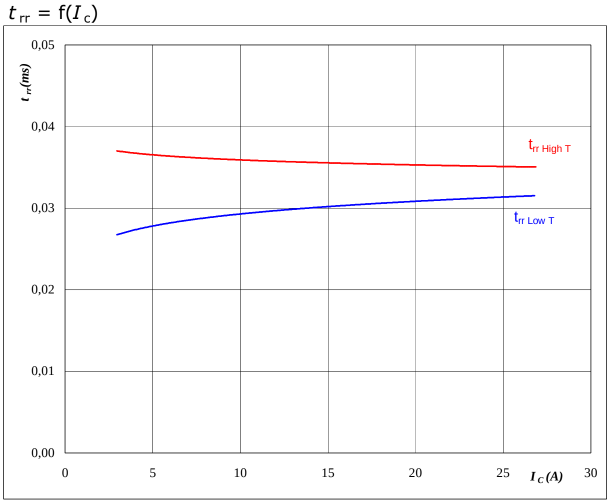
With an inductive load at

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

$t_{rr} = f(I_c)$



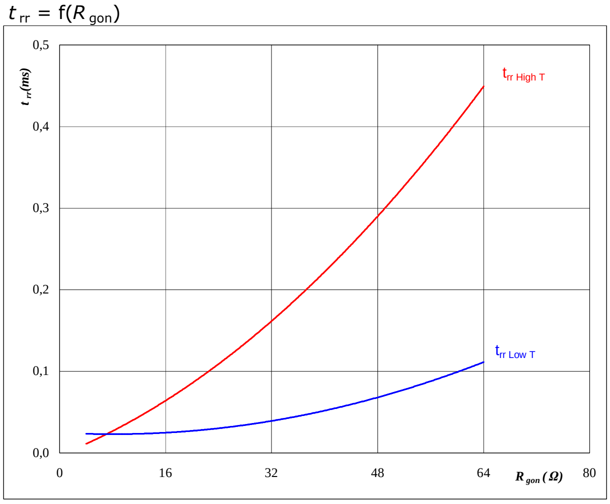
At

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

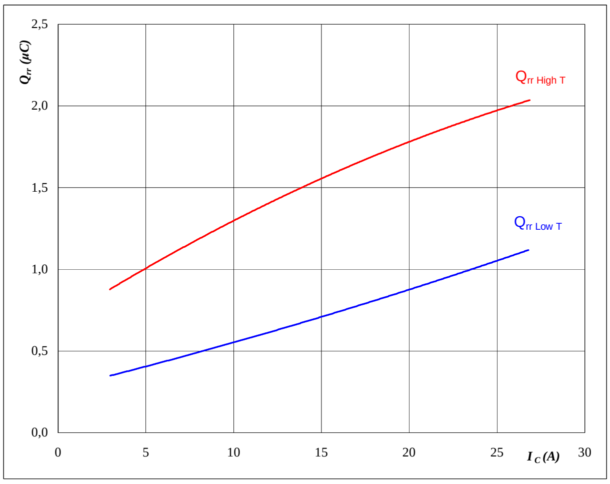
Neutral Point

Neutral Point IGBT & Half Bridge FWD

figure 13. **FWD**

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$



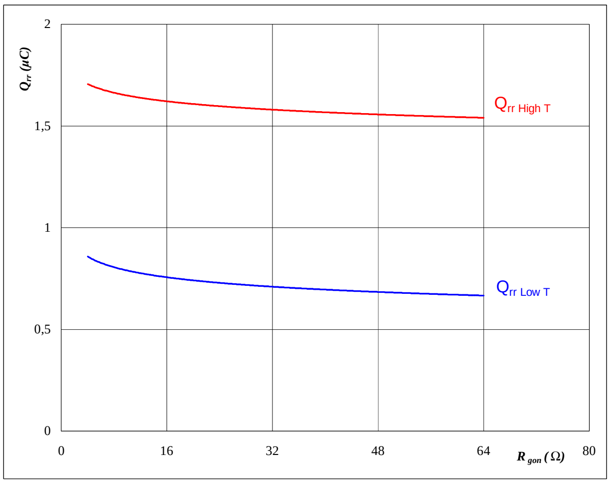
At

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

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



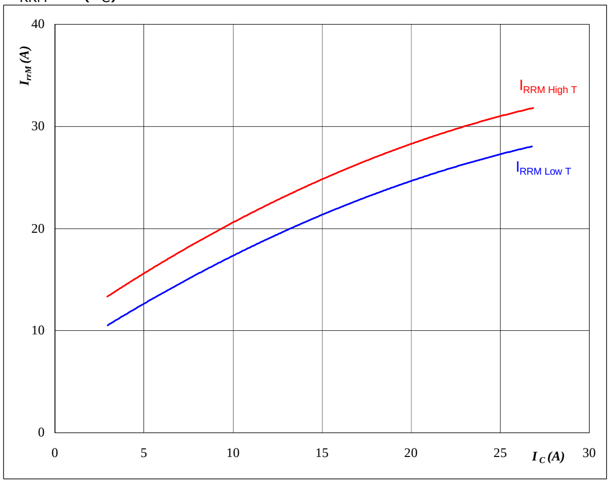
At

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

$I_{RRM} = f(I_C)$



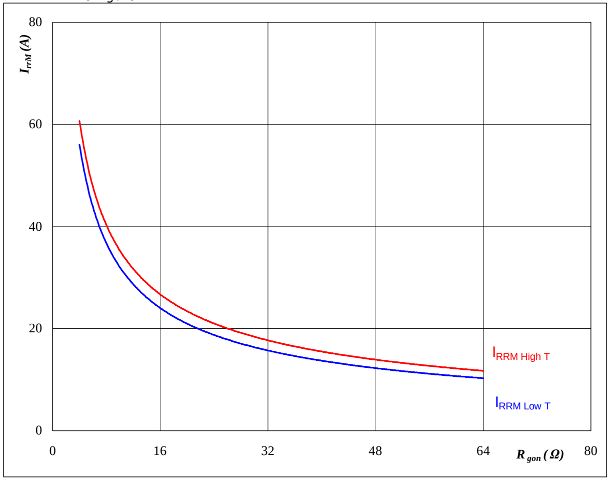
At

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

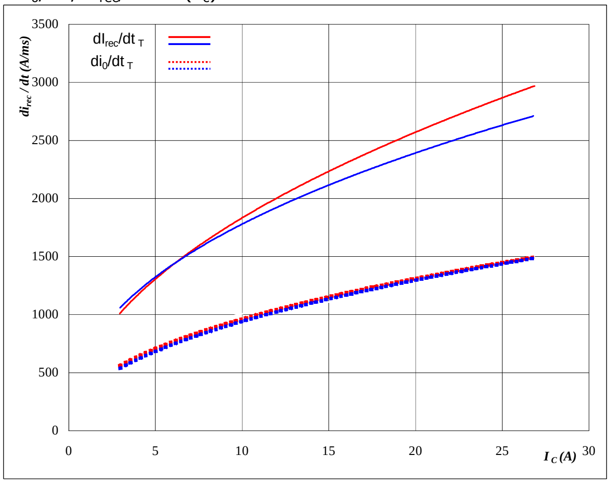
Neutral Point

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

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



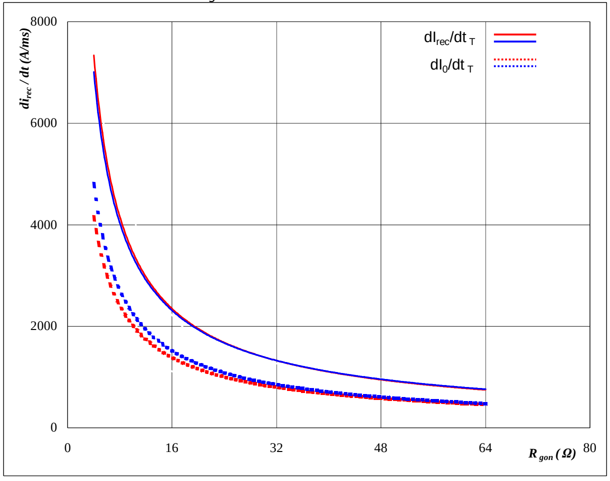
At

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

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



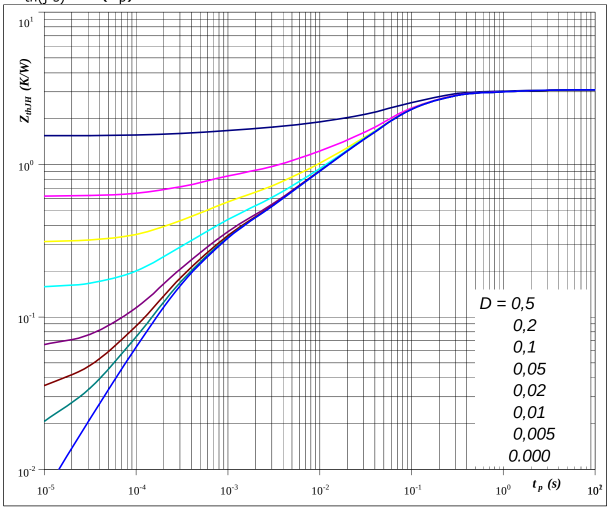
At

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

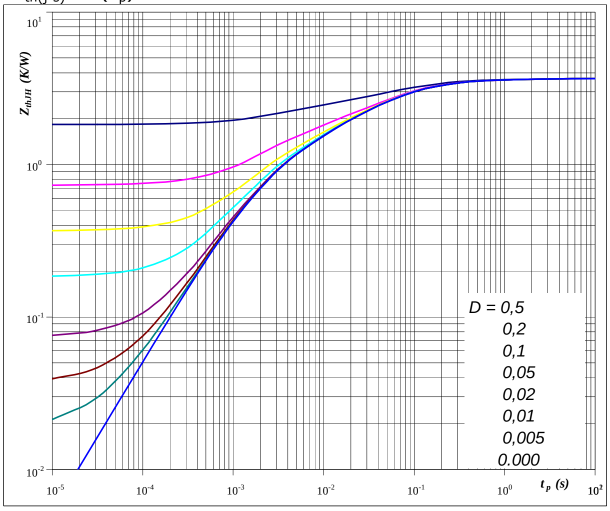
IGBT thermal model values

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

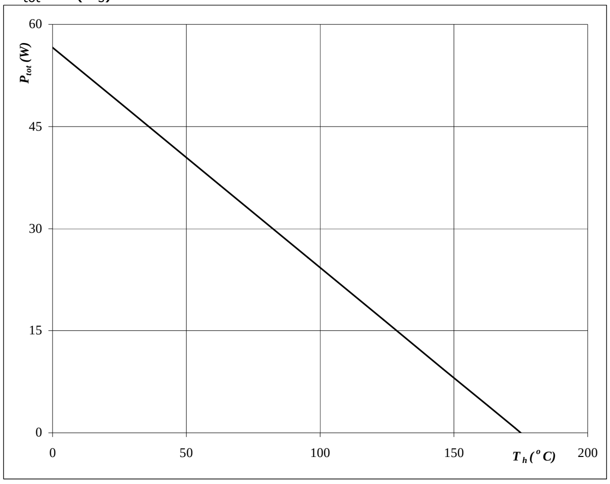
Neutral Point

Neutral Point IGBT & Half Bridge FWD

figure 21. **IGBT**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



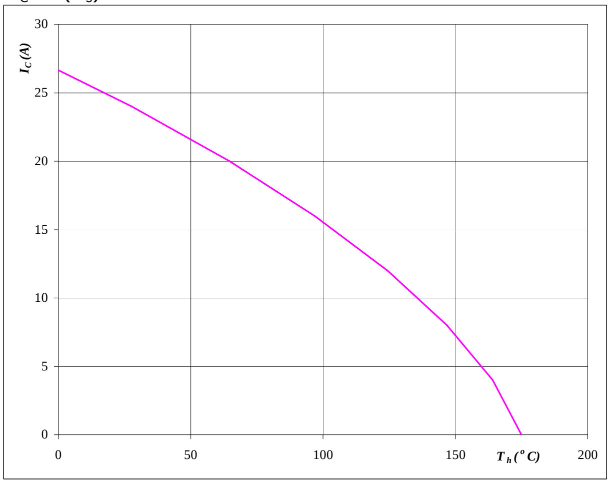
At

T_j = 175 ºC

figure 22. **IGBT**

Collector current as a function of heatsink temperature

$I_C = f(T_s)$



At

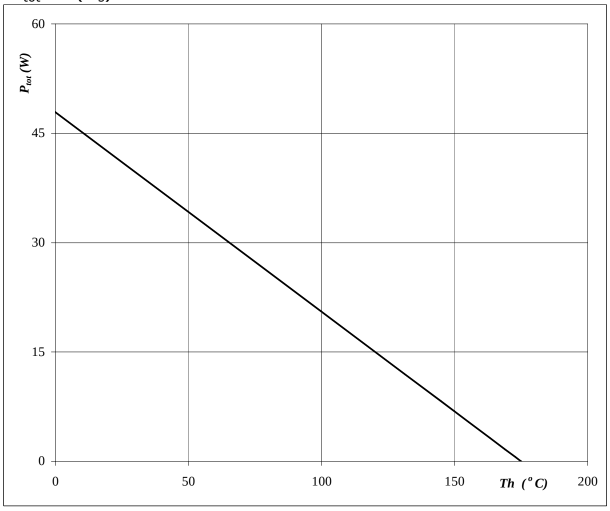
T_j = 175 ºC

V_{GE} = 15 V

figure 23. **FWD**

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$



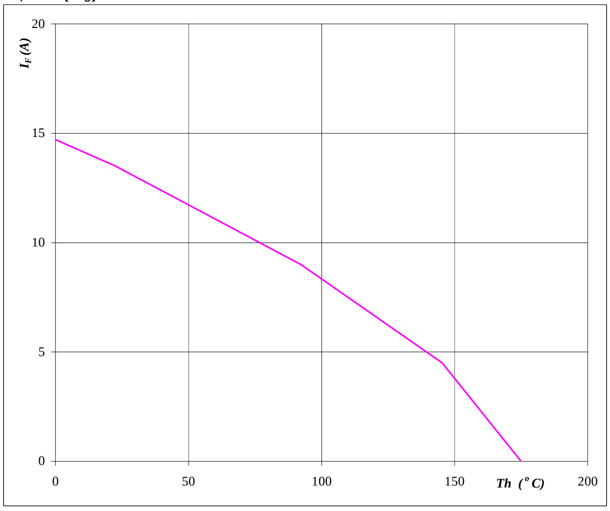
At

T_j = 175 ºC

figure 24. **FWD**

Forward current as a function of heatsink temperature

$I_F = f(T_s)$



At

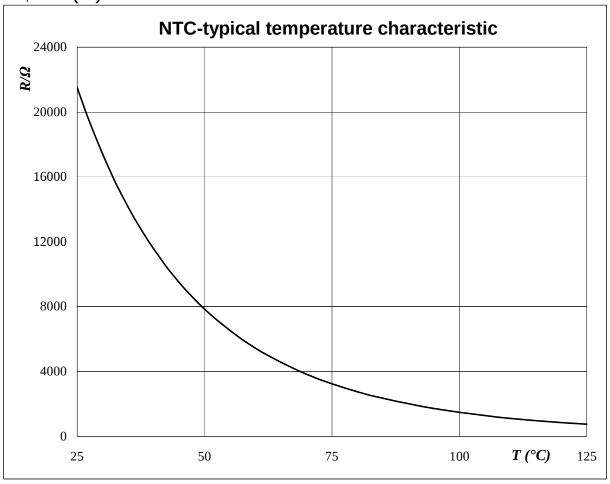
T_j = 175 ºC

Thermistor

figure 1.	Thermistor

Typical NTC characteristic
as a function of temperature

R$_T$ = f(*T*)



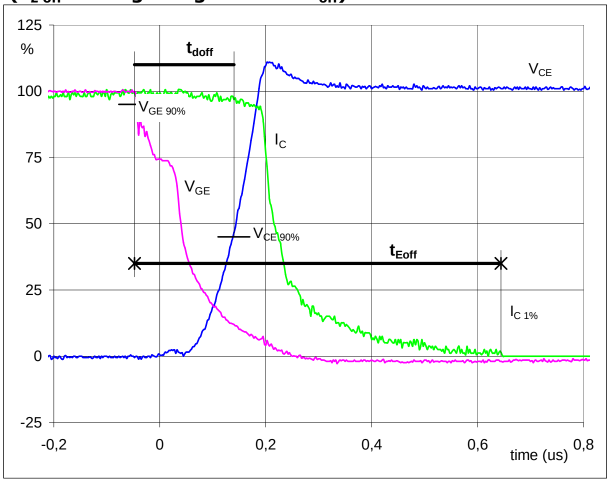
Switching Definitions Half Bridge

General conditions

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

figure 1. **IGBT**

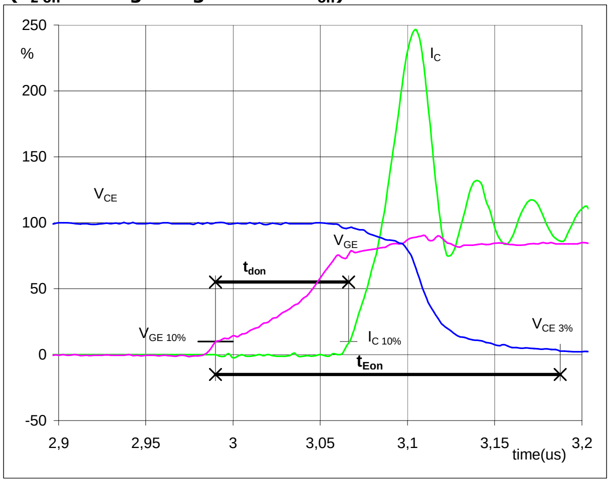
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



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**

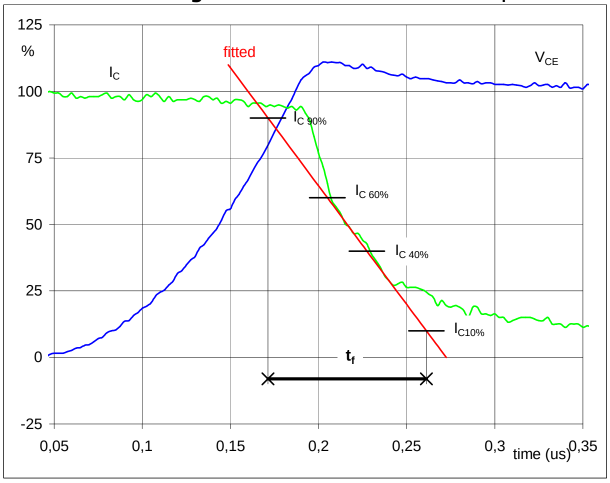
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



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**

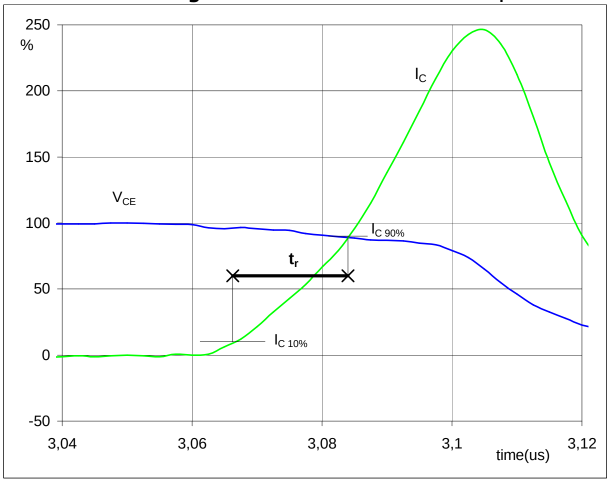
Turn-off Switching Waveforms & definition of t_f



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

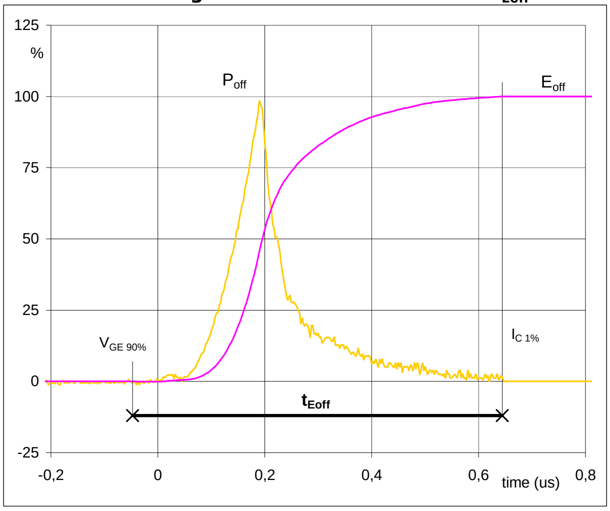


V_C (100%) =	350	V
I_C (100%) =	15	A
t_r =	0,02	µs

Switching Definitions Half Bridge

figure 5. **IGBT**

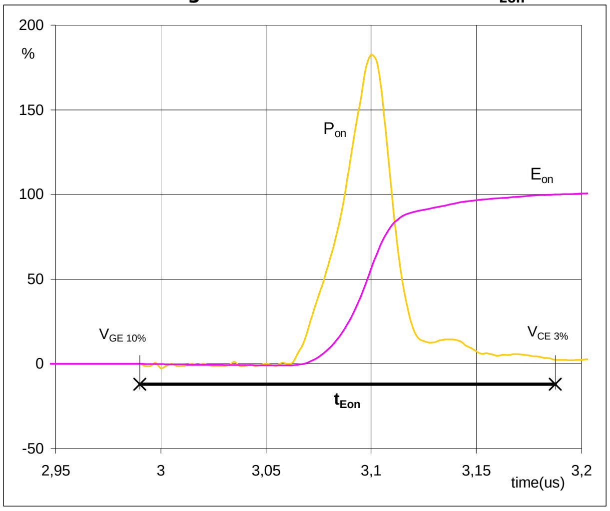
Turn-off Switching Waveforms & definition of t_{Eoff}



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

figure 6. **IGBT**

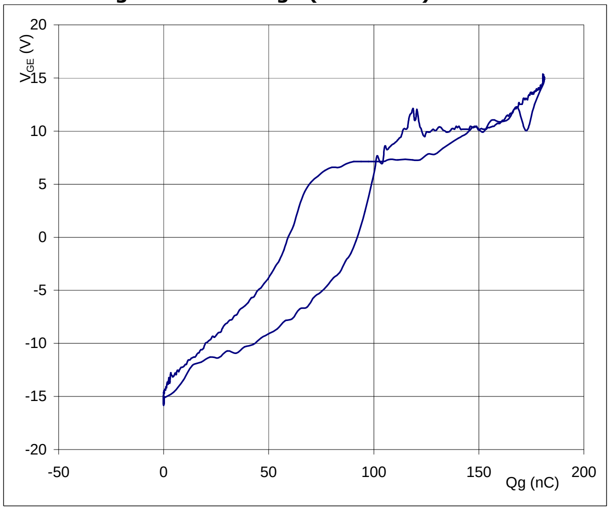
Turn-on Switching Waveforms & definition of t_{Eon}



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

figure 7. **IGBT**

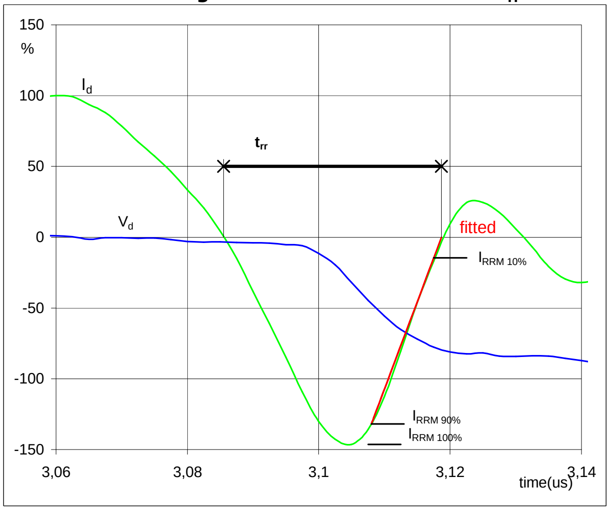
Gate voltage vs Gate charge (measured)



$V_{GE\,off}$ =	-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}

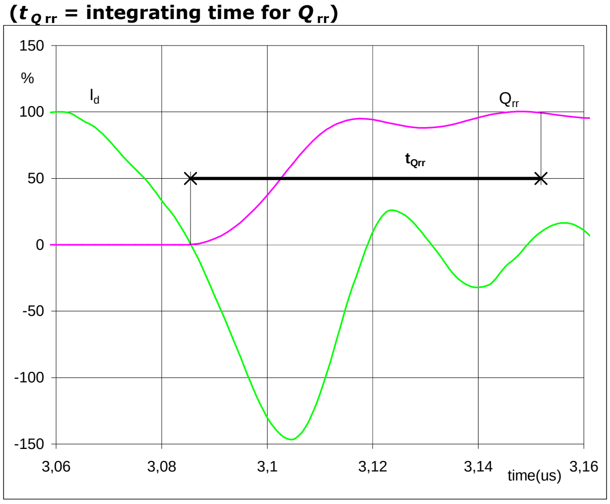


V_d (100%) =	350	V
I_d (100%) =	15	A
I_{RRM} (100%) =	-22	A
t_{rr} =	0,03	μs

Switching Definitions Half Bridge

figure 9. **IGBT**

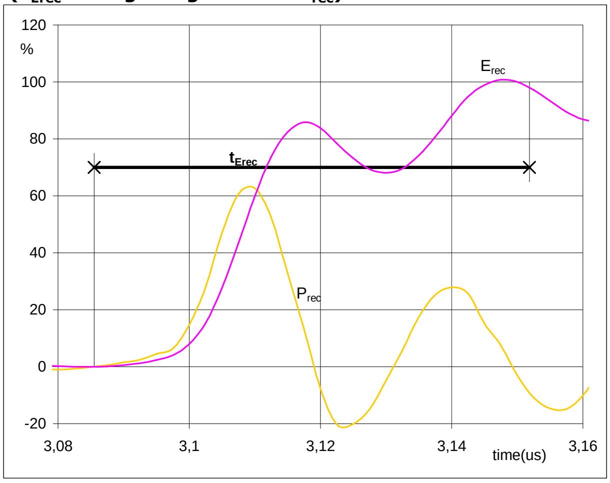
Turn-on Switching Waveforms & definition of t_{Qrr}
($t_{Q rr}$ = integrating time for Q_{rr})



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})

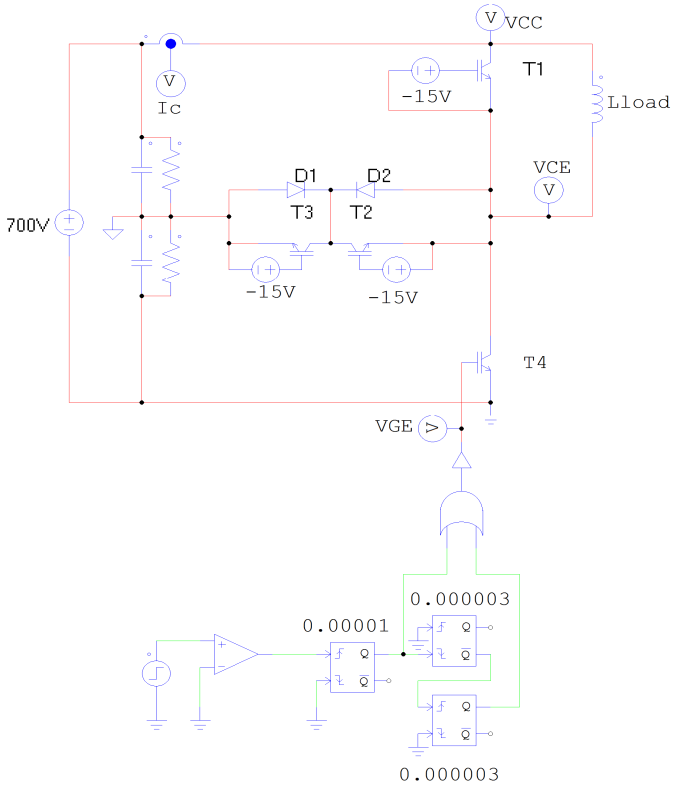


P_{rec} (100%) =	5,28	kW
E_{rec} (100%) =	0,05	mJ
$t_{E rec}$ =	0,07	μs

Half Bridge switching measurement circuit

figure 11.

Half Bridge stage switching measurement circuit



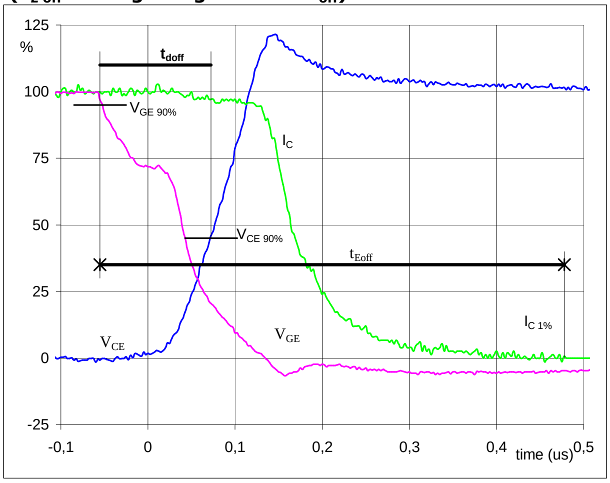
Switching Definitions Neutral Point

General conditions

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

figure 1. **Neutral Point IGBT**

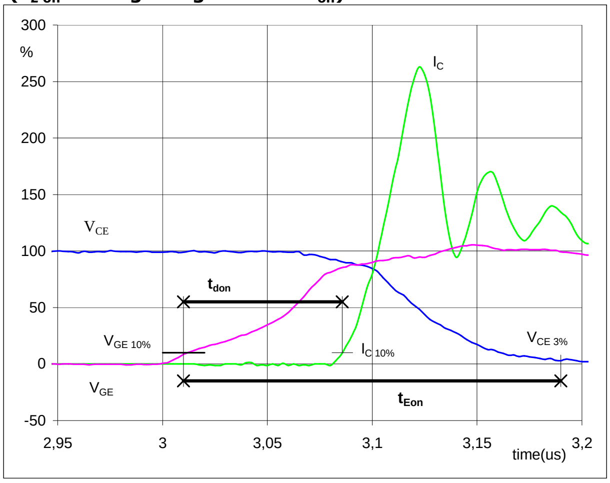
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff}
($t_{E\,off}$ = integrating time for E_{off})



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**

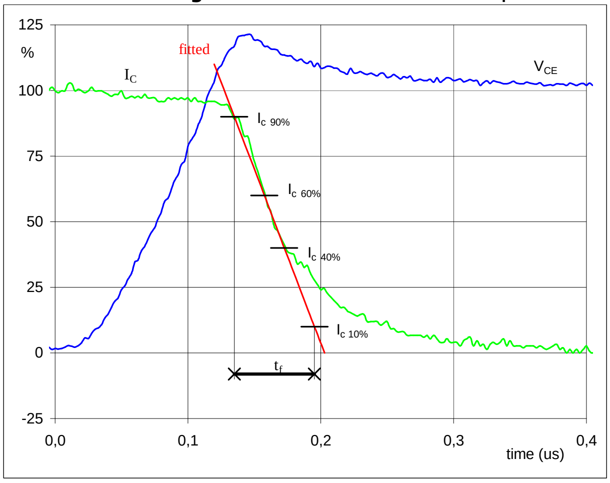
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon}
($t_{E\,on}$ = integrating time for E_{on})



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**

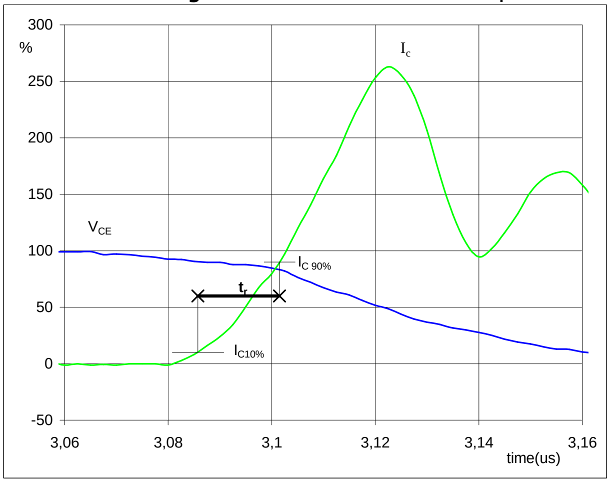
Turn-off Switching Waveforms & definition of t_f



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

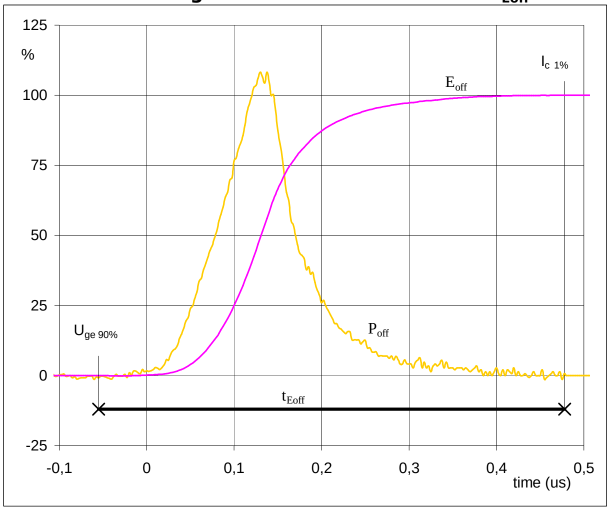


V_C (100%) =	350	V
I_C (100%) =	15	A
t_r =	0,016	μs

Switching Definitions Neutral Point

figure 5. **Neutral Point IGBT**

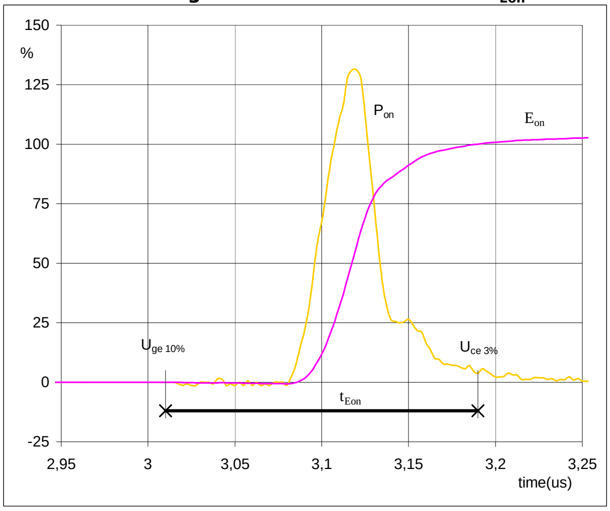
Turn-off Switching Waveforms & definition of *t*$_{Eoff}$



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

figure 6. **Neutral Point IGBT**

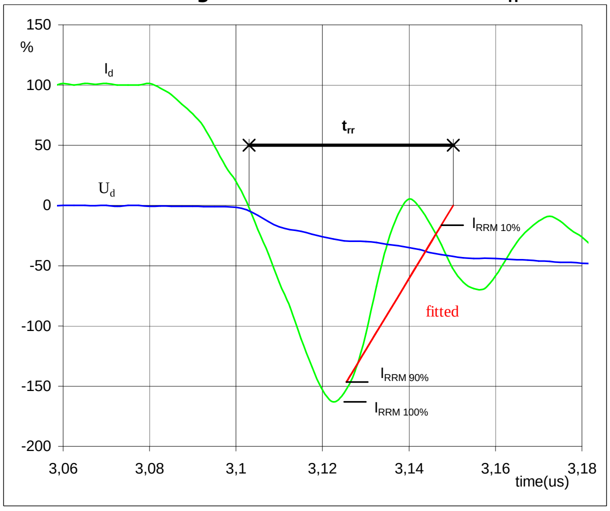
Turn-on Switching Waveforms & definition of *t*$_{Eon}$



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

figure 8. **Half Bridge FWD**

Turn-off Switching Waveforms & definition of *t*$_{rr}$

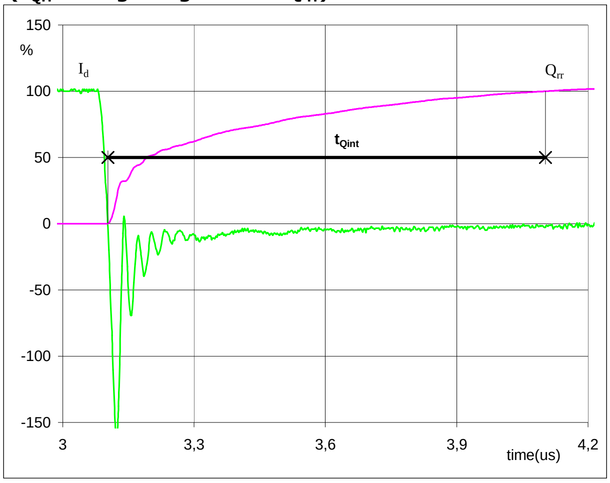


V_d (100%) =	350	V
I_d (100%) =	15	A
I_{RRM} (100%) =	-24	A
t_{rr} =	0,04	µs

Switching Definitions Neutral Point

figure 9. **Half Bridge FWD**

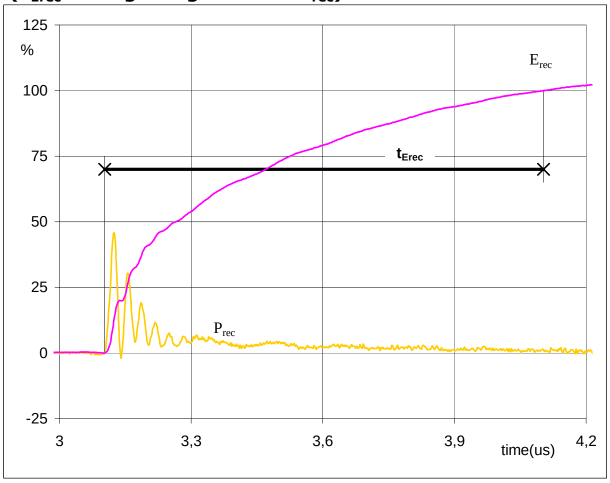
Turn-on Switching Waveforms & definition of t_{Qrr}
(t_{Qrr}= integrating time for Q_{rr})



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})

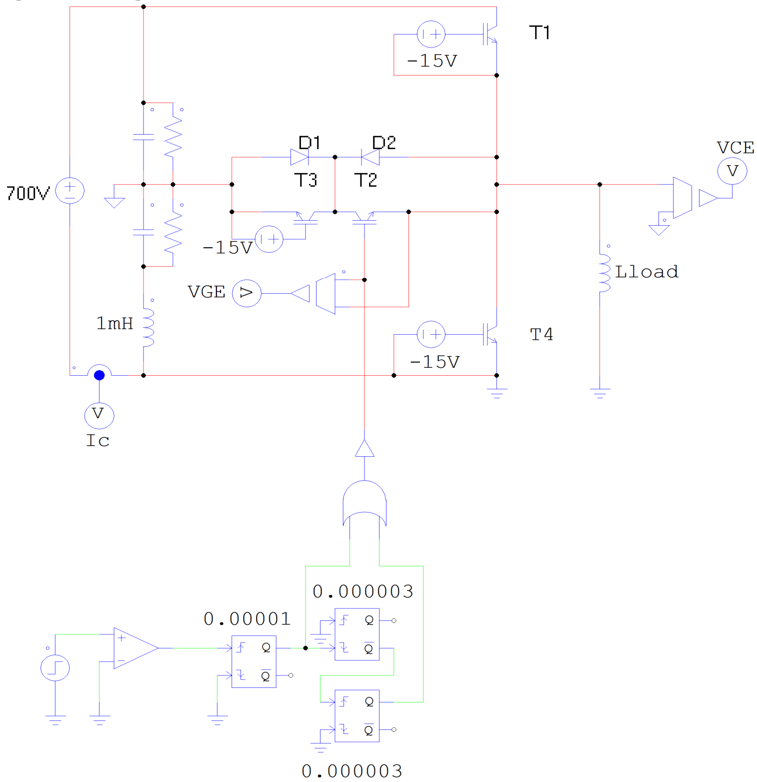


P_{rec} (100%) =	5,26	kW
E_{rec} (100%) =	0,38	mJ
$t_{E\,rec}$ =	1,00	µs

Neutral Point switching measurement circuit

figure 11.

Neutral Point stage switching measurement circuit



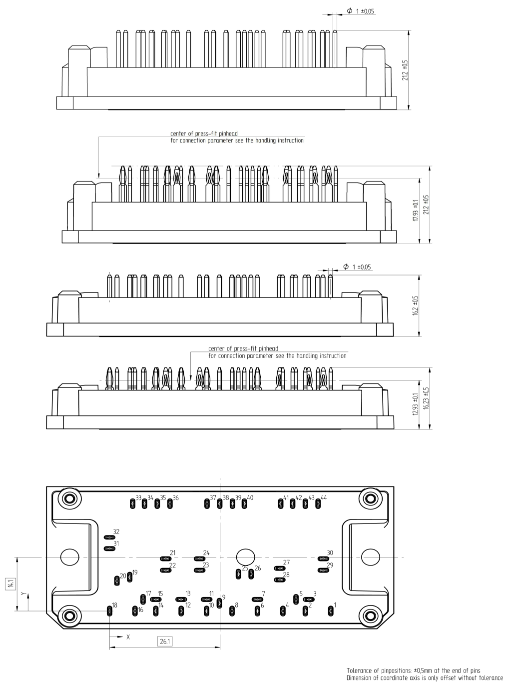
Ordering Code & Marking

Version	Ordering Code
without thermal paste 12 mm housing with solder pins	10-FY12M3A025SH-M746F08
without thermal paste 12 mm housing with press-fit pins	10-PY12M3A025SH-M746F08Y
with thermal paste 12 mm housing with solder pins	10-FY12M3A025SH-M746F08-/3/
with thermal paste 12 mm housing with press-fit pins	10-PY12M3A025SH-M746F08Y-/3/
without thermal paste 17 mm housing with solder pins	10-F112M3A025SH-M746F09
without thermal paste 17 mm housing with press-fit pins	10-P112M3A025SH-M746F09Y
with thermal paste 17 mm housing with solder pins	10-F112M3A025SH-M746F09-/3/
with thermal paste 17 mm housing with press-fit pins	10-P112M3A025SH-M746F09Y-/3/

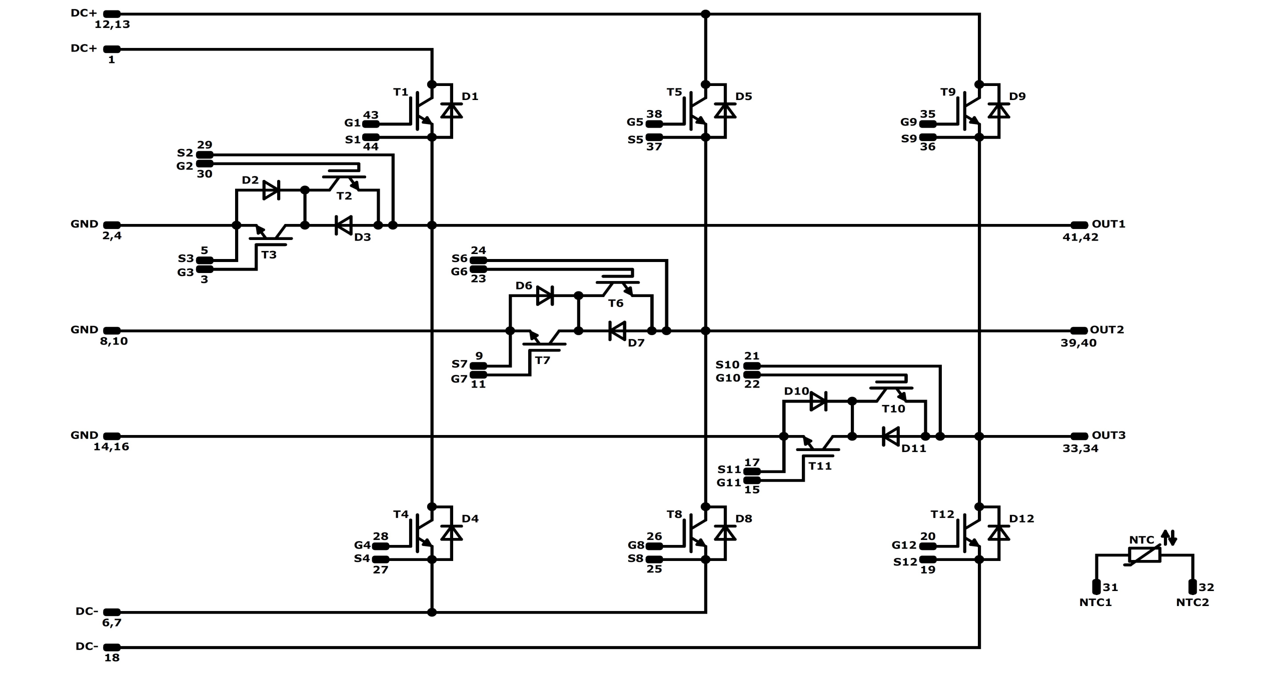
	Name	Date code	UL & VIN	Lot	Serial
Text	NN-NNNNNNNNNNNNNN-TTTTTTVV	WWYY	UL VIN	LLLLL	SSSS
Datamatrix	Type&Ver	Lot number	Serial	Date code	
	TTTTTTTVV	LLLLL	SSSS	WWYY	

Outline

Pin table [mm]				Pin table [mm]			
Pin	X	Y	Function	Pin	X	Y	Function
1	52,2	0	+DC	23	21,25	10,7	G6
2	46,2	0	GND	24	21,25	13,7	S6
3	47	3	G3	25	30,4	9,7	S8
4	40,9	0	GND	26	33,4	9,7	G8
5	44	3	S3	27	40,15	11,2	S4
6	34,9	0	-DC	28	40,15	8,2	G4
7	34,9	3	-DC	29	50,45	10,7	S2
8	28,9	0	GND	30	50,45	13,7	G2
9	25,9	2	S7	31	0	16,35	NTC1
10	22,9	0	GND	32	0	19,35	NTC2
11	22,9	3	G7	33	5,45	28,2	OUT3
12	16,9	0	+DC	34	8,25	28,2	OUT3
13	16,9	3	+DC	35	11,25	28,2	G9
14	10,9	0	GND	36	14,25	28,2	S9
15	10,9	3	G11	37	23	28,2	S5
16	6	0	GND	38	26	28,2	G5
17	7,9	3	S11	39	29	28,2	OUT2
18	0	0	-DC	40	31,8	28,2	OUT2
19	4,75	8,9	S12	41	40,4	28,2	OUT1
20	1,75	7,9	G12	42	43,2	28,2	OUT1
21	13,25	13,7	S10	43	46,2	28,2	G1
22	13,25	10,7	G10	44	49,2	28,2	S1



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1,T4,T5,T8,T9,T12	IGBT	1200 V	25 A	Half Bridge IGBT	
D1,D4,D5,D8,D9,D12	FWD	1200 V	8 A	Half Bridge FWD	
T2,T3,T6,T7,T10,T11	IGBT	600 V	20 A	Neutral P. IGBT	
D2,D3,D6,D7,D10,D11	FWD	600 V	15 A	Neutral P. FWD	
NTC	NTC			Thermistor	

Packaging instruction					
Standard packaging quantity (SPQ)	**100**	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 1 packages see vincotech.com website.

Package data
Package data for *flow* 1 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
10-xY12M3A025SH-M746F0xx-D5-14	12 Jul. 2017	Added press-fit version	All