10-FY12M3A025SH03-M746F48
10-PY12M3A025SH03-M746F48Y
datasheet

Vincotech

flow **AMNPC 1** | **1200 V / 25 A**

Features

- 3 phase mixed voltage component topology
- Neutral point clamped inverter
- Reactive power capability
- Low inductance layout

flow 1 12 mm housing

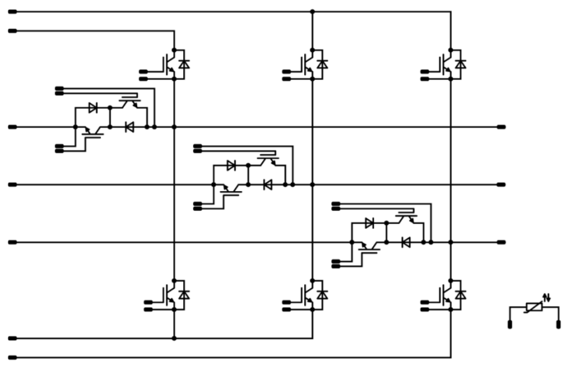
with press-fit pins

with solder pins

Target applications

- Solar Inverter
- UPS

Schematic



Types

- 10-FY12M3A025SH03-M746F48
- 10-PY12M3A025SH03-M746F48Y

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Half Bridge Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	31	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		75	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	94	W
Gate-emitter voltage	V_{GES}			±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 Diode					
Peak repetitive reverse voltage	V_{RRM}			650	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	28	A
Repetitive peak forward current	I_{FRM}			40	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	52	W
Maximum junction temperature	T_{jmax}			175	°C
Neutral Point Switch					
Collector-emitter voltage	V_{CES}			650	V
Collector current	I_C	$T_j = T_{jmax}$	T_s = 80 °C	24	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		60	A
Turn off safe operating area		$T_j \leq$ 150 °C, $V_{CE} \leq$ 600 V		60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	46	W
Gate-emitter voltage	V_{GES}			±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 Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$	T_s = 80 °C	11	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	39	W
Maximum Junction Temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Module Properties					
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{jop}			-40…(T_{jmax} - 25)	°C
Isolation Properties					
Isolation voltage	V_{isol}	DC Test Voltage	t_p = 2 s	4000	V
Creepage distance				>12,7	mm
Clearance			solder pins / press-fit pins	8,19 / 7,97	mm
Comparative Tracking Index	CTI			> 200	

Characteristic Values

Parameter	Symbol	Conditions	V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Half Bridge Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,00085	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		25	25 125 150	1,78	1,98 2,38 2,49	2,42	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			62	µA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		1430		pF
Output capacitance	C_{oes}							115		
Reverse transfer capacitance	C_{res}							75		
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,01		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 16 Ω R_{gon} = 16 Ω	±15	350	15	25 125 150		71 74 72		ns
Rise time	t_r					25 125 150		16 19 20		
Turn-off delay time	$t_{d(off)}$					25 125 150		162 217 230		
Fall time	t_f					25 125 150		24 84 81		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,6 µC Q_{rFWD} = 1 µC Q_{rFWD} = 1,2 µC				25 125 150		0,240 0,368 0,410		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,380 0,651 0,730		

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Neutral Point Diode										
Static										
Forward voltage	V_F				20	25 125		1,56 1,51	1,92	V
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,82		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 1013 A/µs di/dt = 1058 A/µs di/dt = 1027 A/µs	±15	350	15	25 125 150		17 19 19		A
Reverse recovery time	t_{rr}					25 125 150		64 100 113		ns
Recovered charge	Q_r					25 125 150		0,619 1,020 1,182		µC
Reverse recovered energy	E_{rec}					25 125 150		0,131 0,210 0,246		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		871 132 130		A/µs

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Neutral Point Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,00029	25	5,1	5,8	6,4	V
Collector-emitter saturation voltage	V_{CEsat}		15		20	25 125	1,03	1,49 1,67	1,87	V
Collector-emitter cut-off current	I_{CES}		0	650		25			5	µA
Gate-emitter leakage current	I_{GES}		20	0		25			150	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		1100		pF
Output capacitance	C_{oes}							71		
Reverse transfer capacitance	C_{res}							32		
Gate charge	Q_g		15	480	20	25		120		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						2,06		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 16 Ω R_{gon} = 16 Ω	±15	350	15	25 125 150		82 80 81		ns
Rise time	t_r					25 125 150		14 16 16		
Turn-off delay time	$t_{d(off)}$					25 125 150		132 155 157		
Fall time	t_f					25 125 150		31 71 64		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,6 µC Q_{rFWD} = 1,3 µC Q_{rFWD} = 1,5 µC				25 125 150		0,274 0,341 0,375		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,441 0,583 0,627		

Characteristic Values

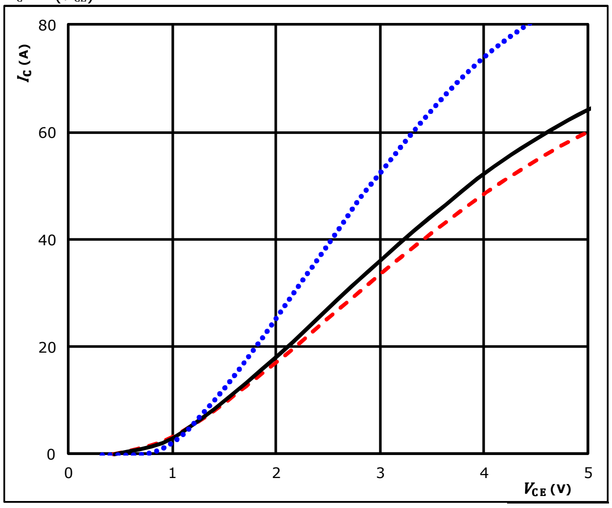
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Half Bridge Diode										
Static										
Forward voltage	V_F				8	25 150		2,30 2,26	2,65	V
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						2,44		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 1302 A/µs di/dt = 1138 A/µs di/dt = 1104 A/µs	±15	350	15	25 125 150		21 23 25		A
Reverse recovery time	t_{rr}					25 125 150		29 35 38		ns
Recovered charge	Q_r					25 125 150		0,587 1,311 1,530		µC
Reverse recovered energy	E_{rec}					25 125 150		0,113 0,321 0,376		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		1953 1991 2057		A/µs
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P					25		5		mW
Power dissipation constant						25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %				25		3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %				25		4000		K
Vincotech NTC Reference									I	

Half Bridge Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

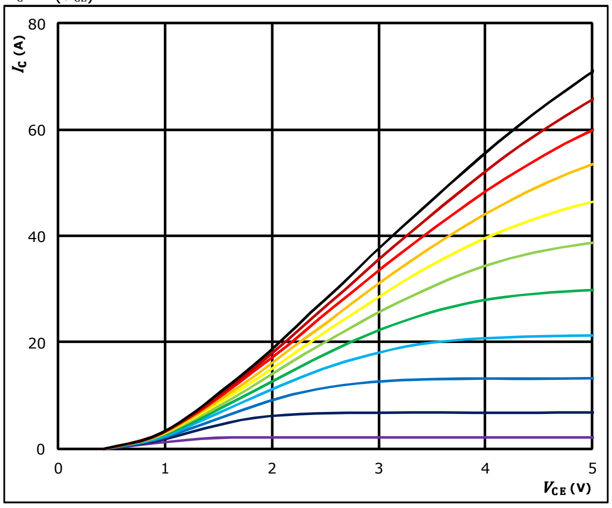


t_p =	250	μs		25 °C	dotted blue
V_{GE} =	15	V	T_j:	125 °C	solid black
				150 °C	dashed red

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



t_p = 250 μs

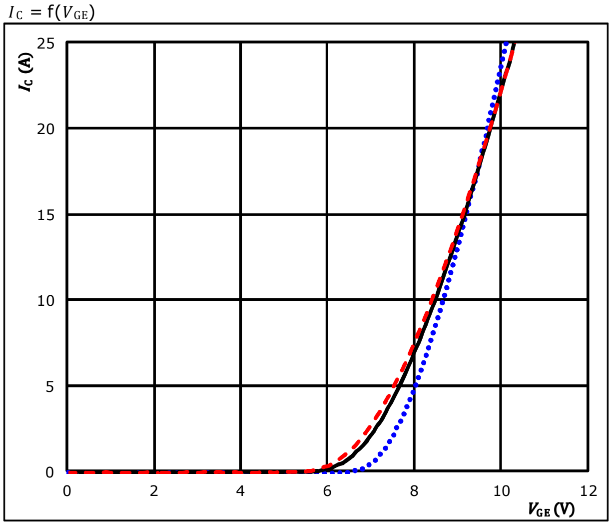
T_j = 150 °C

V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

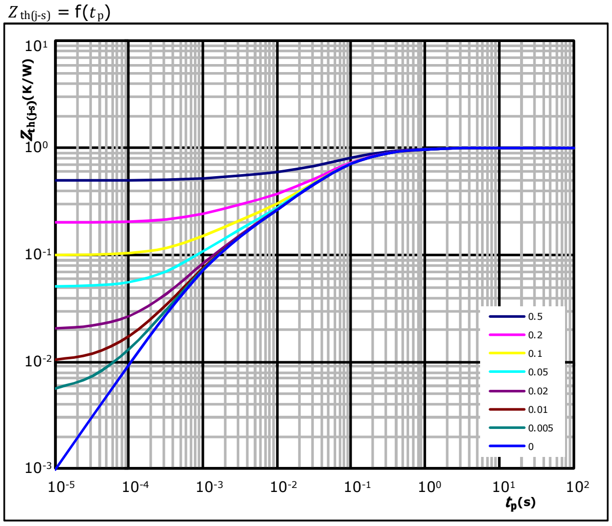


t_p =	100	μs		25 °C	dotted blue
V_{CE} =	10	V	T_j:	125 °C	solid black
				150 °C	dashed red

figure 4. **IGBT**

Transient Thermal Impedance as function of Pulse duration

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



D = t_p / T

$R_{th(j-s)}$ = 1,01 K/W

IGBT thermal model values

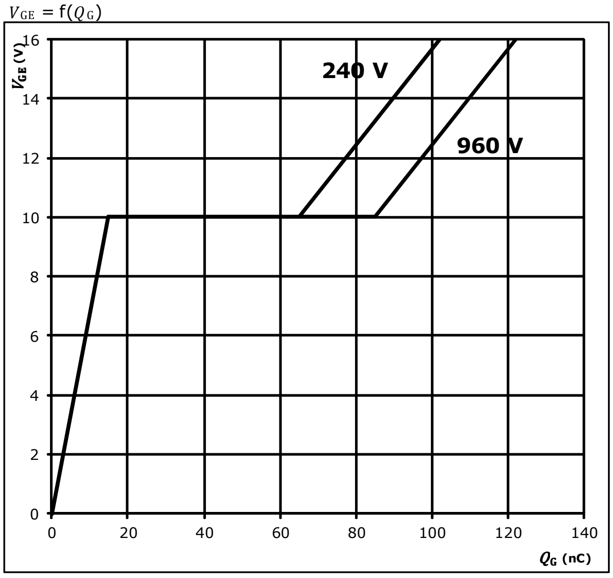
R (K/W)	τ (s)
8,44E-02	1,03E+00
2,46E-01	1,79E-01
4,48E-01	5,38E-02
1,38E-01	1,04E-02
5,48E-02	1,66E-03
3,85E-02	8,73E-04

Half Bridge Switch Characteristics

figure 5. **IGBT**

Gate voltage vs Gate charge

$V_{GE} = f(Q_G)$



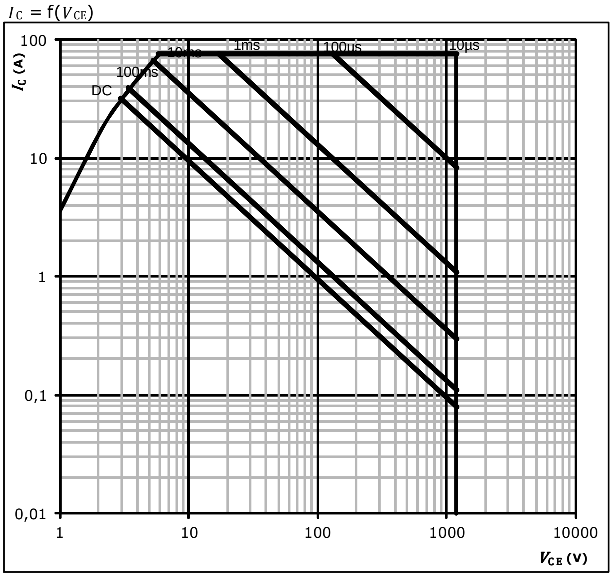
At

I_C =	25	A

figure 6. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



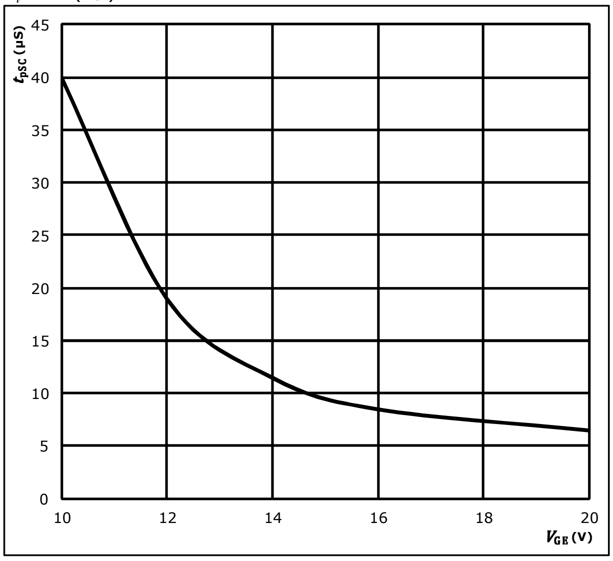
At

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

figure 7. **IGBT**

Short circuit duration as a function of VGE

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



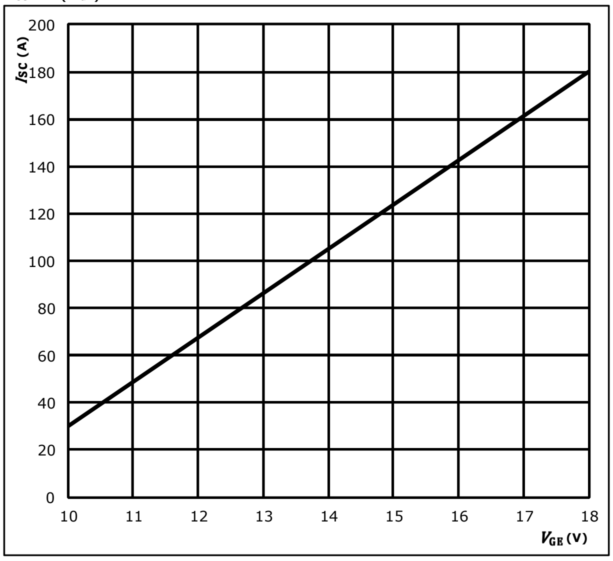
At

V_{CE} =	600	V
T_j ≤	150	ºC

figure 8. **IGBT**

Typical short circuit current as a function of VGE

$I_{SC} = f(V_{GE})$



At

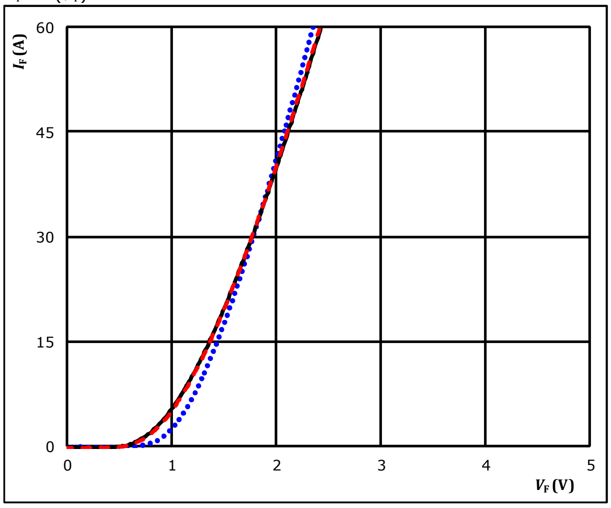
V_{CE} ≤	600	V
T_j ≤	25	ºC

Neutral Point Diode Characteristics

figure 1. FWD

Typical forward characteristics

$I_F = f(V_F)$



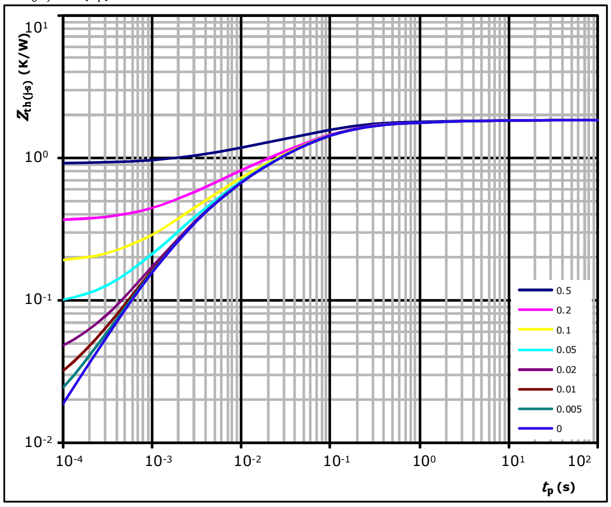
t_p = 250 µs

T_j: 25 °C / 125 °C / 150 °C

figure 2. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 1,82 K/W

FWD thermal model values

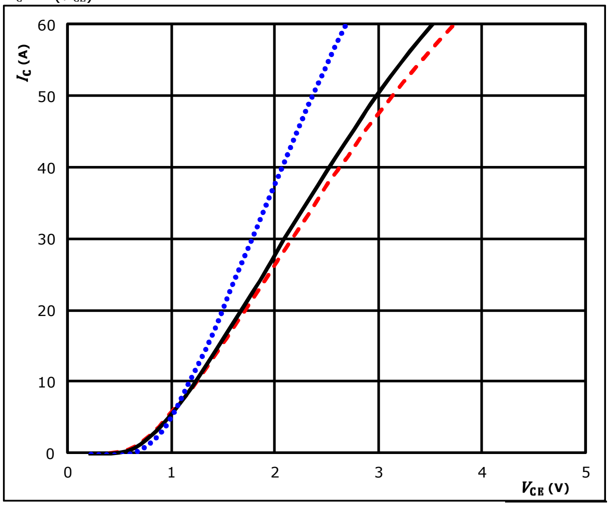
R (K/W)	τ (s)
5,26E-02	5,31E+00
1,17E-01	7,49E-01
5,61E-01	1,08E-01
5,47E-01	3,08E-02
3,91E-01	6,39E-03
1,49E-01	1,43E-03

Neutral Point Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

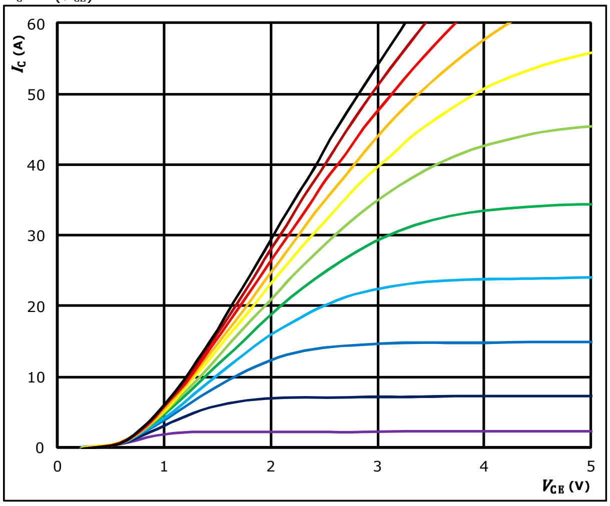


t_p =	250	μs		25 °C	
V_{GE} =	15	V	T_j:	125 °C	
				150 °C	

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



t_p = 250 μs

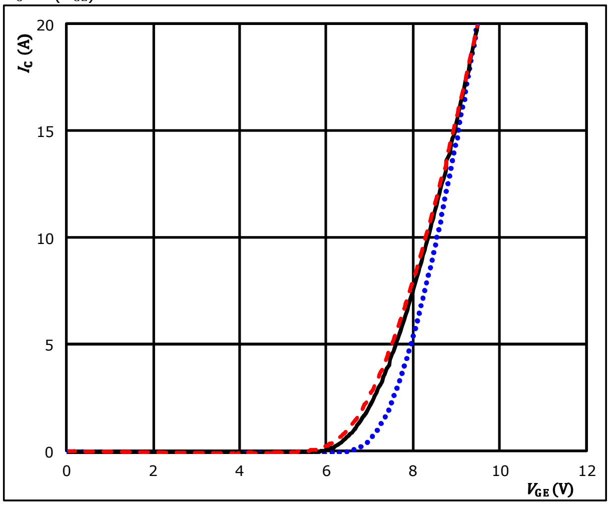
T_j = 150 °C

V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

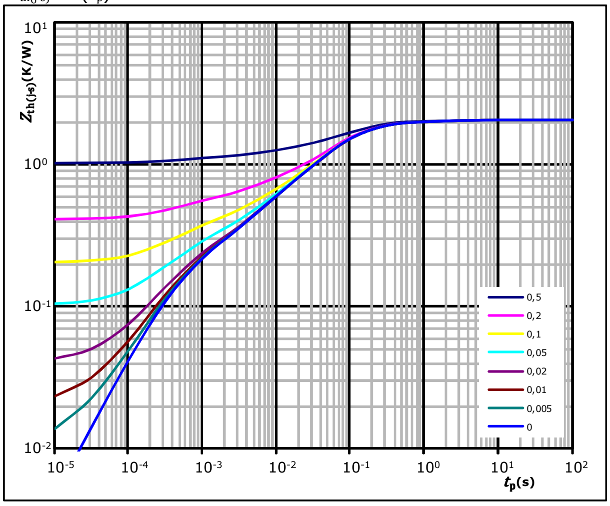


t_p =	100	μs		25 °C	
V_{CE} =	10	V	T_j:	125 °C	
				150 °C	

figure 4. **IGBT**

Transient Thermal Impedance as function of Pulse duration

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



$D = t_p / T$

$R_{th(j-s)}$ = 2,06 K/W

IGBT thermal model values

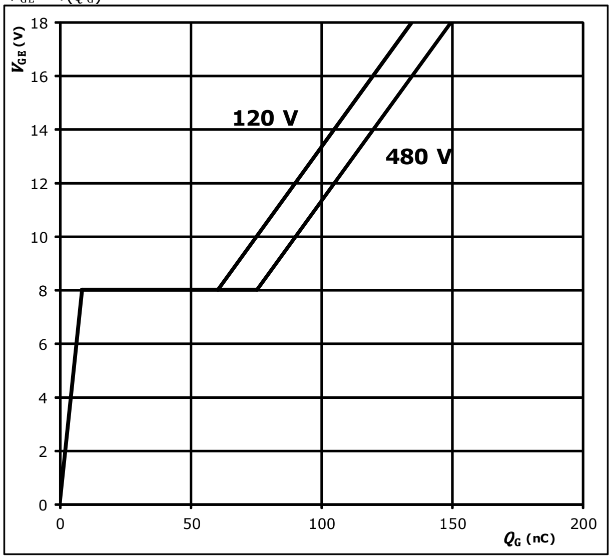
R (K/W)	τ (s)
9,31E-02	1,78E+00
2,45E-01	2,71E-01
1,16E+00	6,94E-02
2,43E-01	1,36E-02
1,64E-01	3,45E-03
1,58E-01	4,12E-04

Neutral Point Switch Characteristics

figure 5. IGBT

Gate voltage vs Gate charge

$V_{GE} = f(Q_G)$



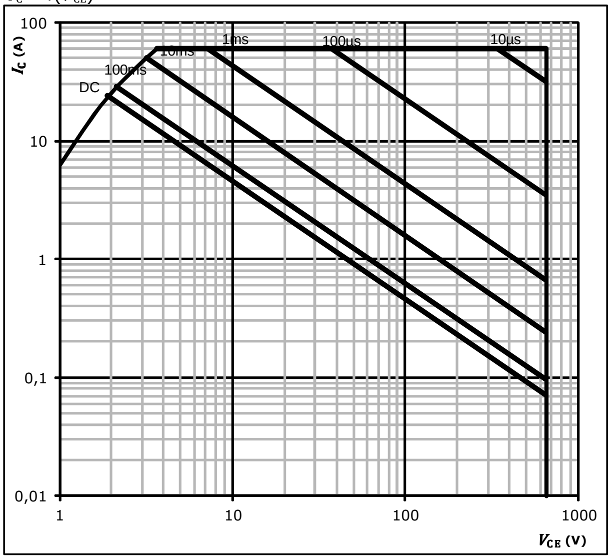
At

I_C =	20	A

figure 6. IGBT

Safe operating area

$I_C = f(V_{CE})$



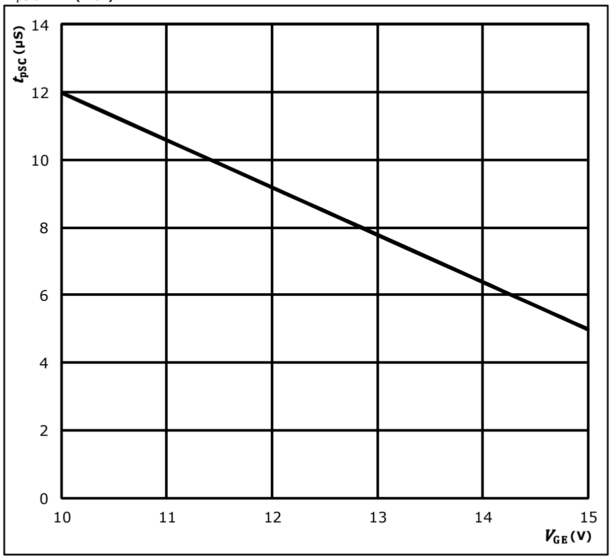
At

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

figure 7. IGBT

Short circuit duration as a function of VGE

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



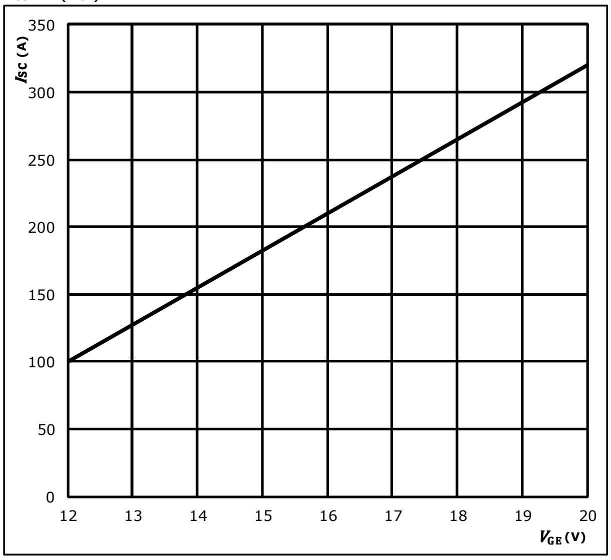
At

V_{CE} =	650	V
T_j ≤	175	ºC

figure 8. IGBT

Typical short circuit current as a function of VGE

$I_{SC} = f(V_{GE})$



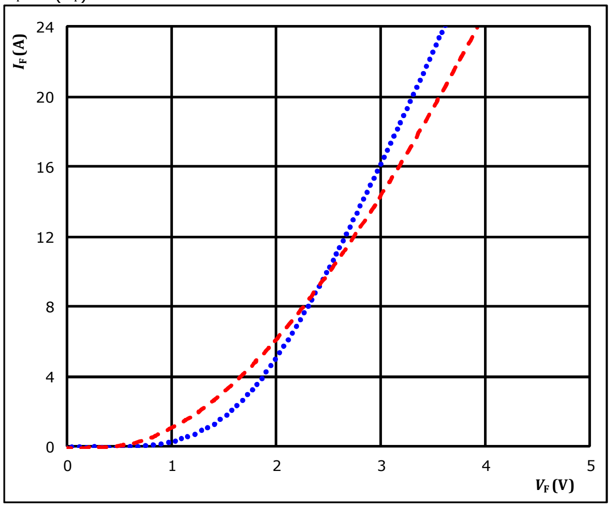
At

V_{CE} ≤	650	V
T_j ≤	175	ºC

Half Bridge Diode Characteristics

figure 1. **FWD**
Typical forward characteristics

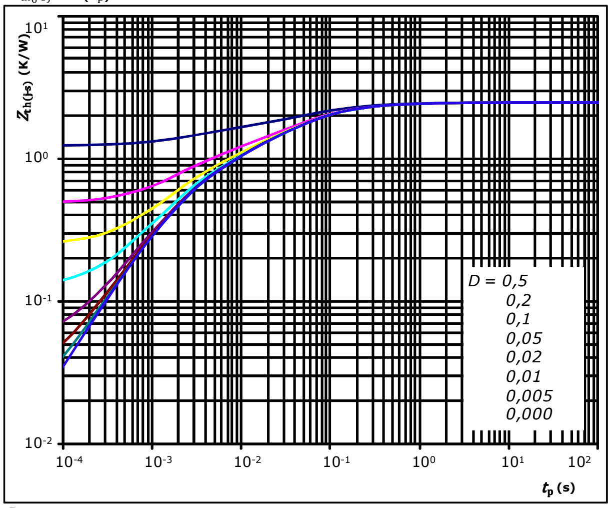
$I_F = f(V_F)$



t_p =	250	μs	25 °C	············
		T_j:	125 °C	———
			150 °C	– – –

figure 2. **FWD**
Transient thermal impedance as a function of pulse width

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



D = t_p / T
$R_{th(j-s)}$ = 2,44 K/W

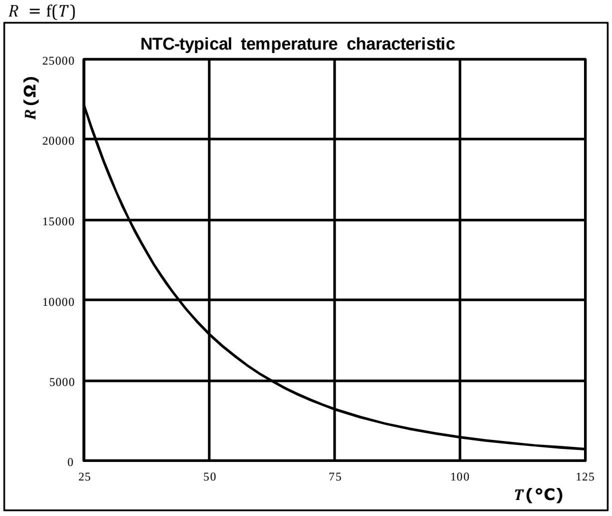
FWD thermal model values

R (K/W)	τ (s)
1,03E-01	1,23E+00
3,89E-01	1,75E-01
9,47E-01	4,78E-02
5,16E-01	8,99E-03
4,81E-01	1,81E-03

Thermistor Characteristics

figure 1. **Thermistor**
Typical NTC characteristic
as a function of temperature

$R = f(T)$

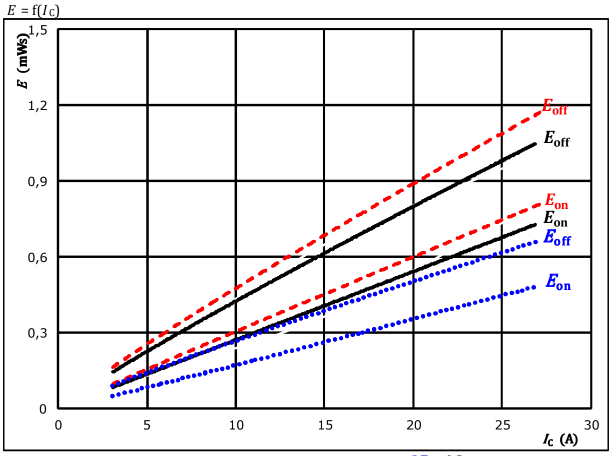


Half Bridge Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



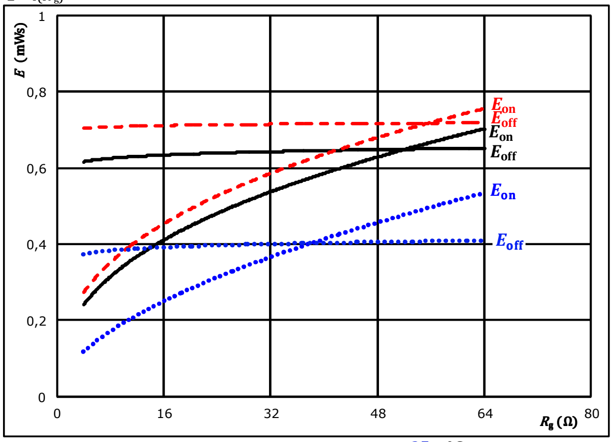
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		150 °C
R_{goff} =	16	Ω		

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



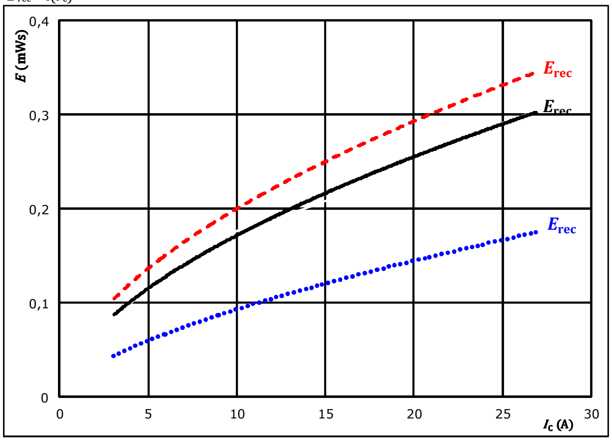
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	15	A		150 °C

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



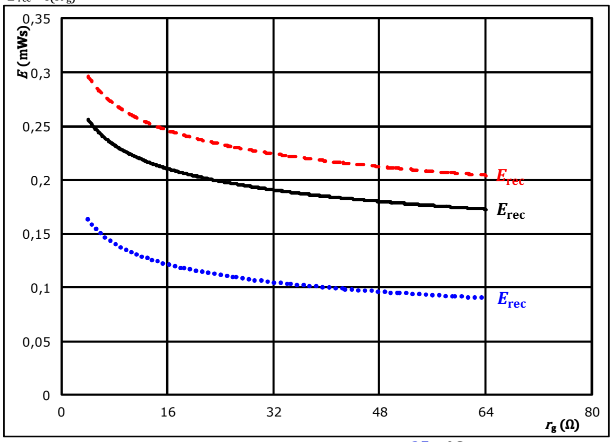
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

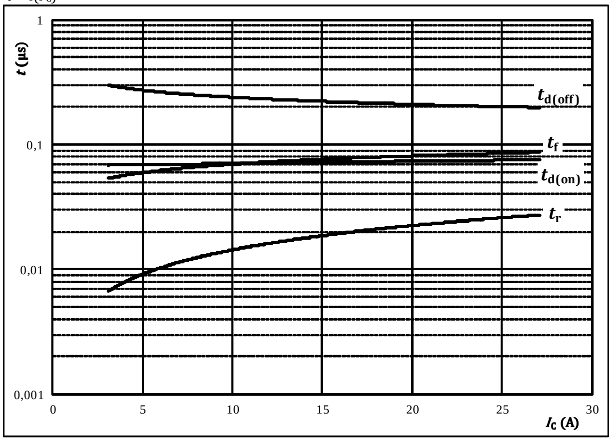
V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	15	A		150 °C

Half Bridge Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



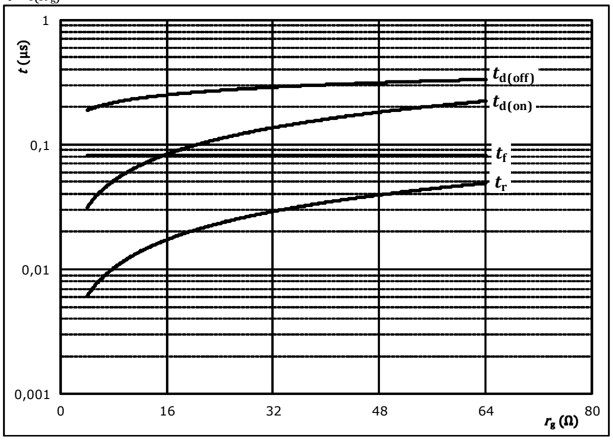
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



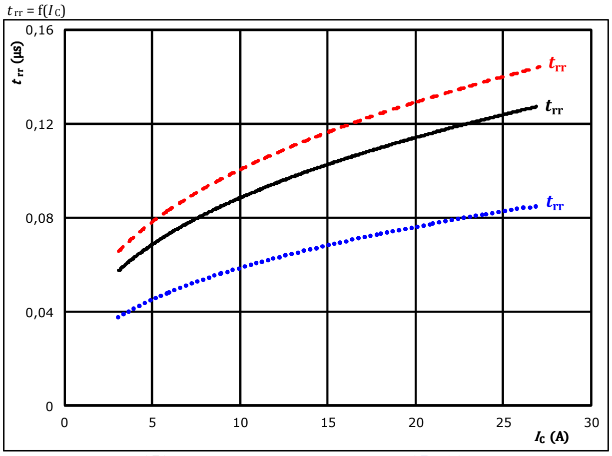
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	15	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

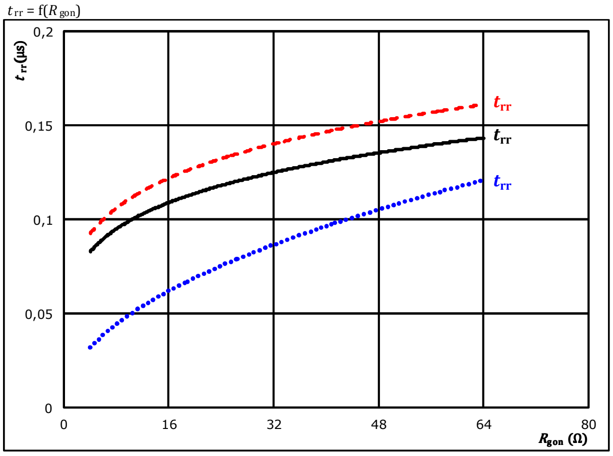


At				
V_{CE} =	350	V	T_j:	25 °C (dotted)
V_{GE} =	±15	V		125 °C (solid)
R_{gon} =	16	Ω		150 °C (dashed)

figure 8. **FWD**

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

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



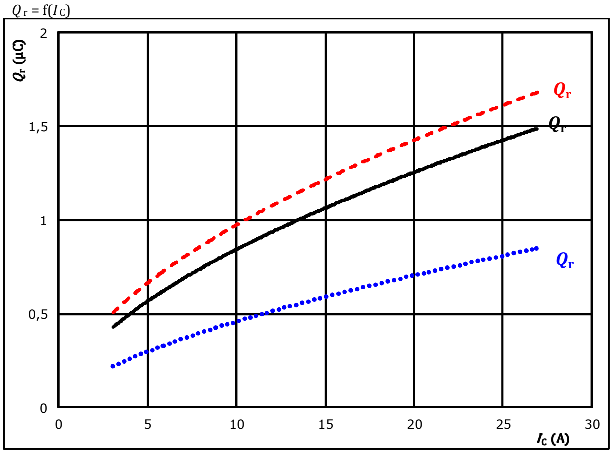
At				
V_{CE} =	350	V	T_j:	25 °C (dotted)
V_{GE} =	±15	V		125 °C (solid)
I_C =	15	A		150 °C (dashed)

Half Bridge Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

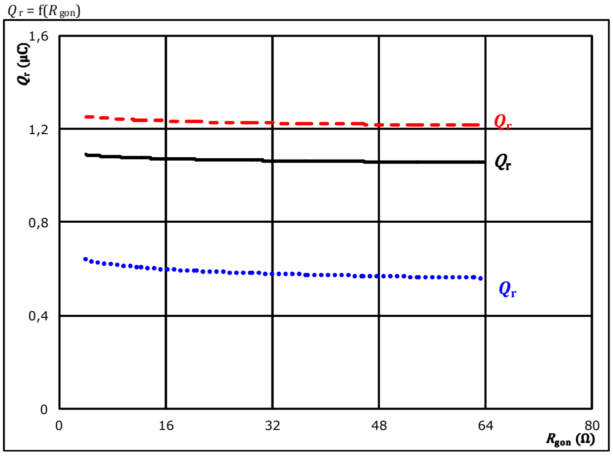


At				
V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 10. FWD

Typical recoved charge as a function of IGBT turn on gate resistor

$Q_r = f(R_{gon})$

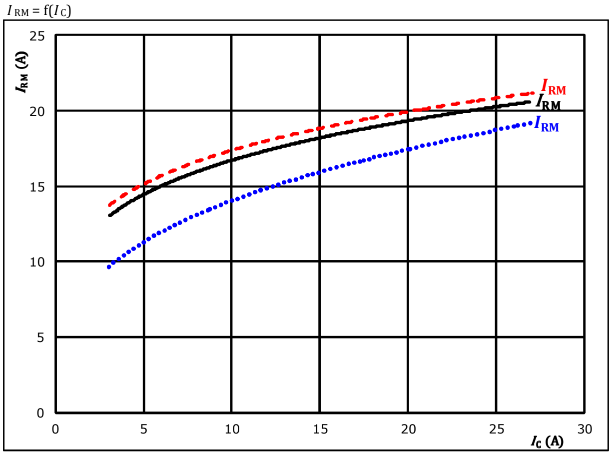


At				
V_{CE}=	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C=	15	A		150 °C

figure 11. FWD

Typical peak reverse recovery current current as a function of collector current

$I_{RM} = f(I_C)$

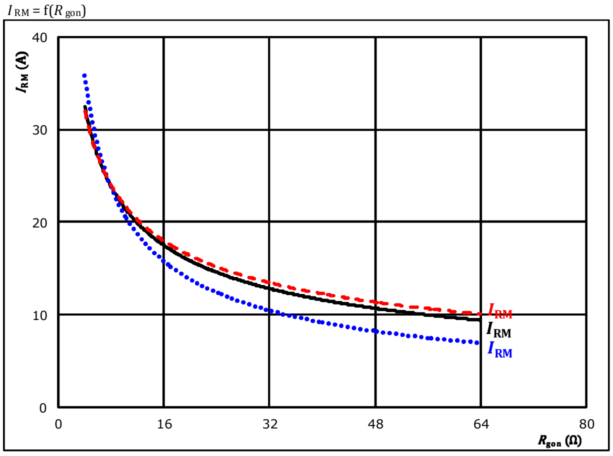


At				
V_{CE}:	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 12. FWD

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

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



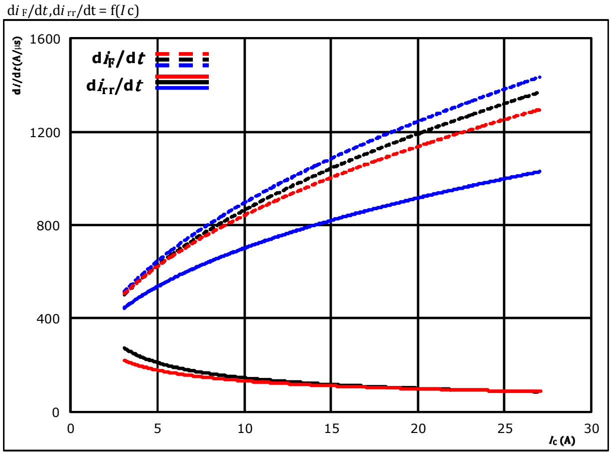
At				
V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	15	A		150 °C

Half Bridge Switching Characteristics

figure 13. FWD

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

$di_F/dt, di_{rr}/dt = f(I_C)$

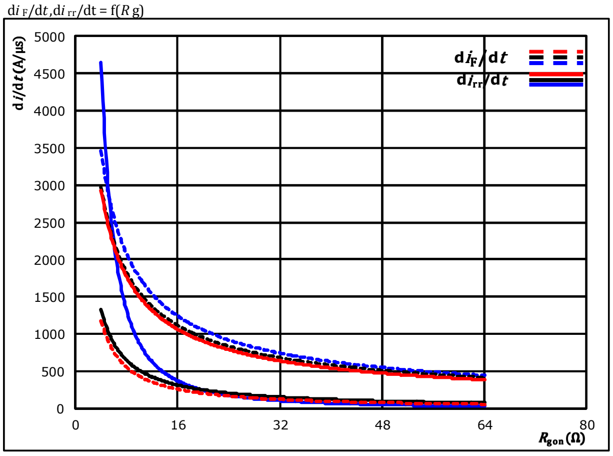


At						
V_{CE} =	350	V	T_j:	25	°C	··········
V_{GE} =	±15	V		125	°C	———
R_{gon} =	16	Ω		150	°C	- - -

figure 14. FWD

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

$di_F/dt, di_{rr}/dt = f(R_g)$

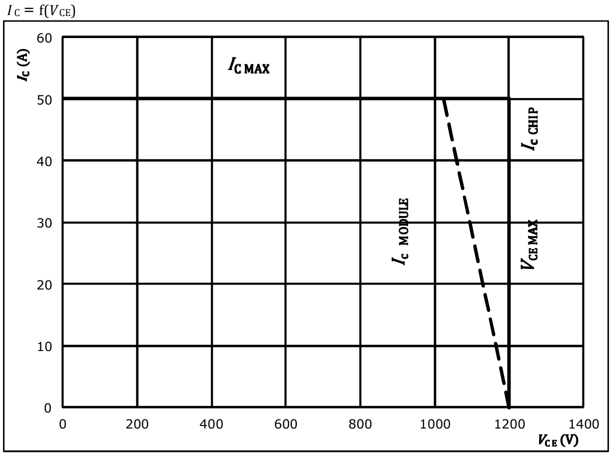


At						
V_{CE} =	350	V	T_j:	25	°C	··········
V_{GE} =	±15	V		125	°C	———
I_C =	15	A		150	°C	- - -

figure 15. IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



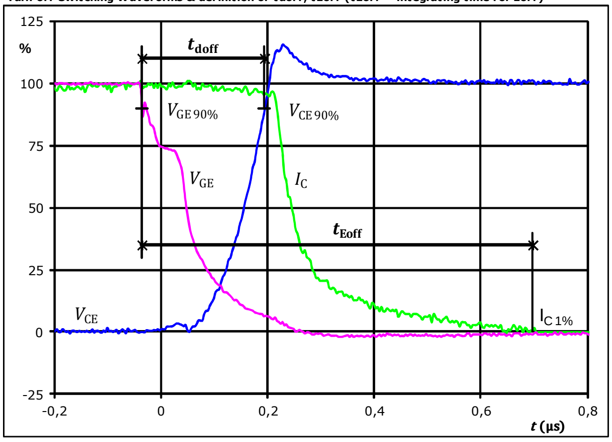
At		
T_j =	175	°C
R_{gon} =	16	Ω
R_{goff} =	16	Ω

Half Bridge Switching Definitions

General conditions		
T_j	=	150 °C
R_{gon}	=	16 Ω
R_{goff}	=	16 Ω

figure 1. IGBT

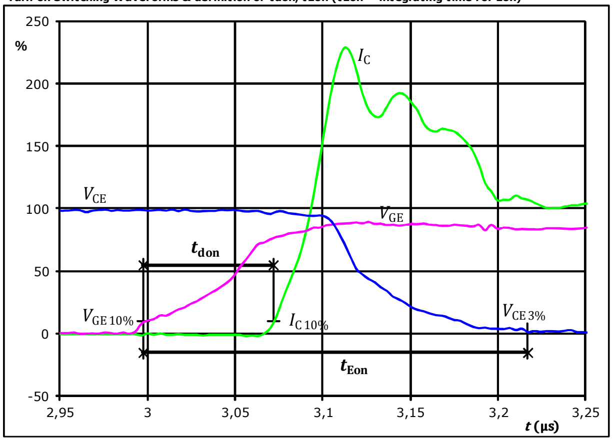
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	15	A
t_{doff} =	0,230	µs
t_{Eoff} =	0,733	µs

figure 2. IGBT

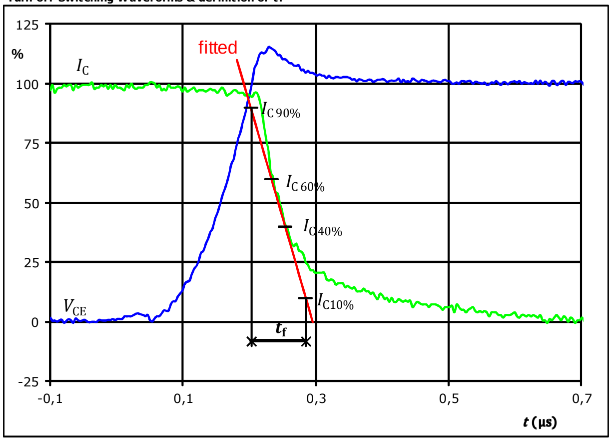
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	15	A
t_{don} =	0,072	µs
t_{Eon} =	0,219	µs

figure 3. IGBT

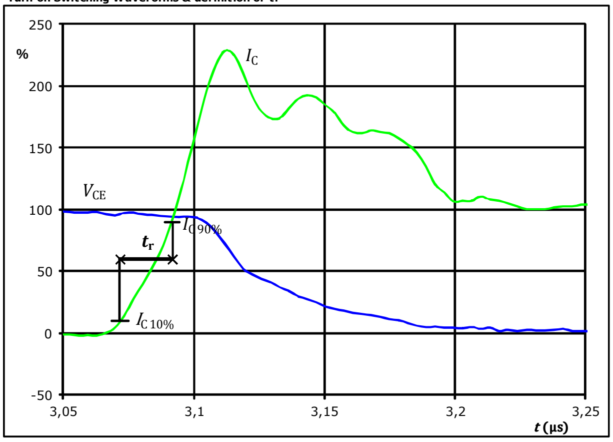
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	15	A
t_f =	0,081	µs

figure 4. IGBT

Turn-on Switching Waveforms & definition of tr

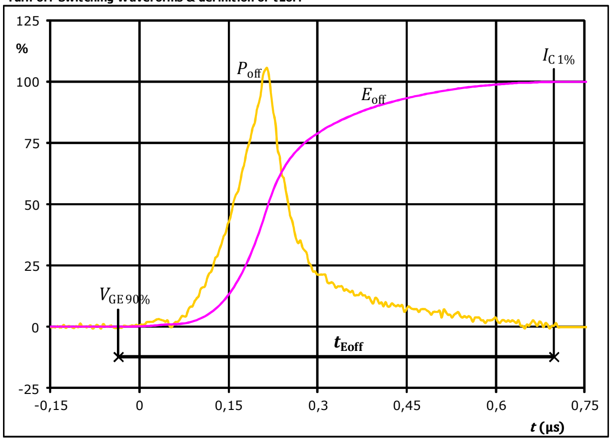


$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	15	A
t_r =	0,020	µs

Half Bridge Switching Characteristics

figure 5. **IGBT**

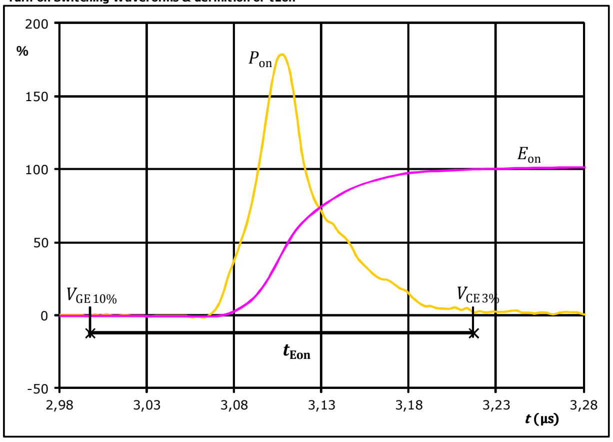
Turn-off Switching Waveforms & definition of tEoff



P_{off} (100%) =	5,28	kW
E_{off} (100%) =	0,73	mJ
t_{Eoff} =	0,73	µs

figure 6. **IGBT**

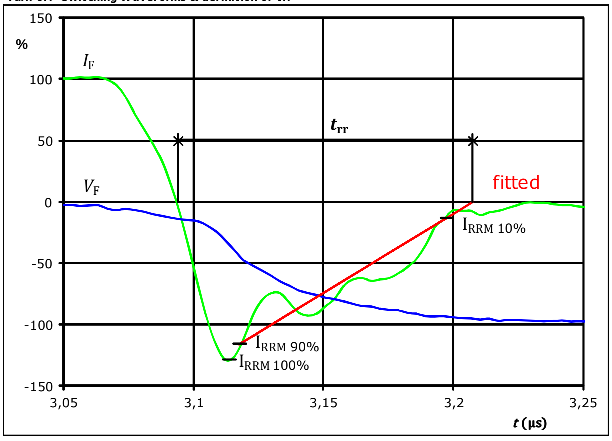
Turn-on Switching Waveforms & definition of tEon



P_{on} (100%) =	5,28	kW
E_{on} (100%) =	0,41	mJ
t_{Eon} =	0,22	µs

figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr

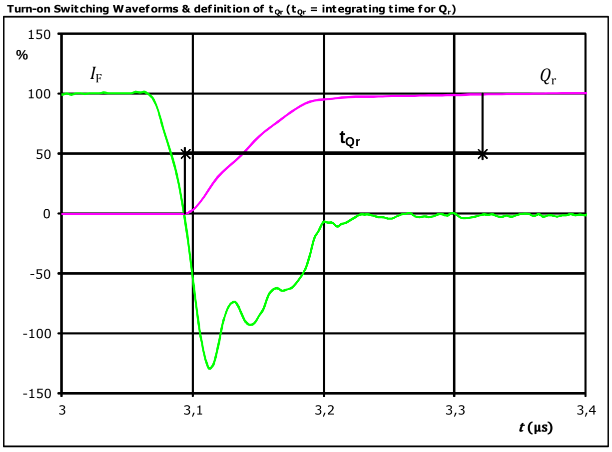


V_F (100%) =	350	V
I_F (100%) =	15	A
I_{RRM} (100%) =	-19	A
t_{rr} =	0,113	µs

Half Bridge Switching Characteristics

figure 8. **FWD**

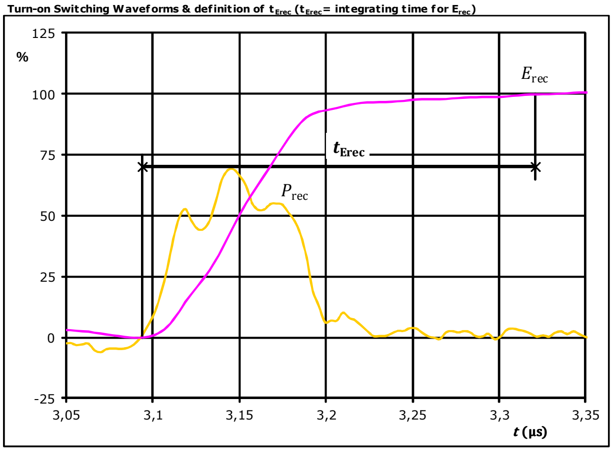
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	15	A
Q_r (100%) =	1,18	µC
t_{Qr} =	0,23	µs

figure 9. **FWD**

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



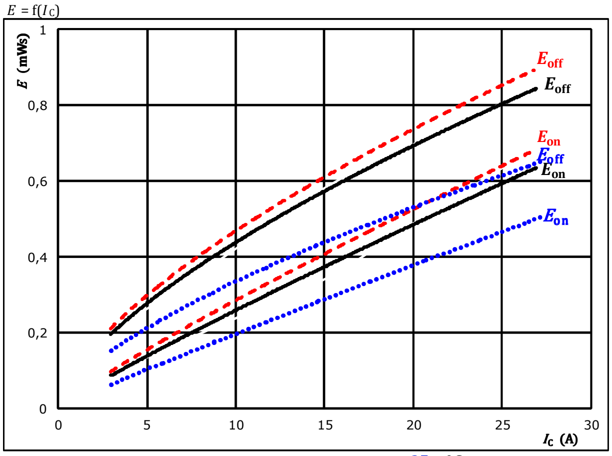
P_{rec} (100%) =	5,28	kW
E_{rec} (100%) =	0,25	mJ
t_{Erec} =	0,23	µs

Neutral Point Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



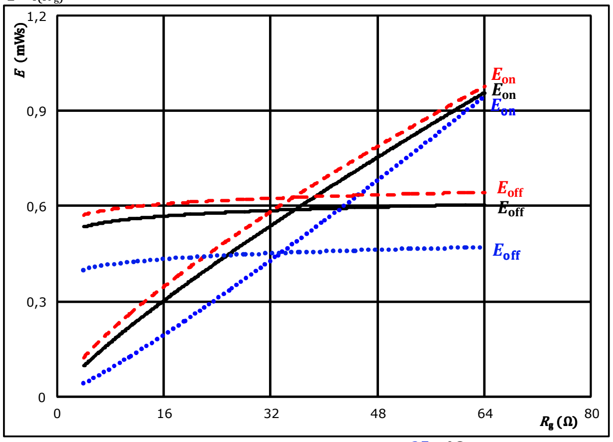
With an inductive load at

V_{CE} =	350	V	T_j: 25 °C	···········
V_{GE} =	±15	V	T_j: 125 °C	———
R_{gon} =	16	Ω	T_j: 150 °C	– – –
R_{goff} =	16	Ω		

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



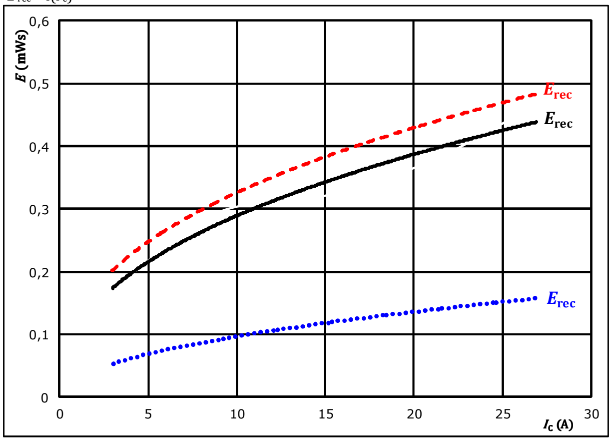
With an inductive load at

V_{CE} =	350	V	T_j: 25 °C	···········
V_{GE} =	±15	V	T_j: 125 °C	———
I_C =	15	A	T_j: 150 °C	– – –

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



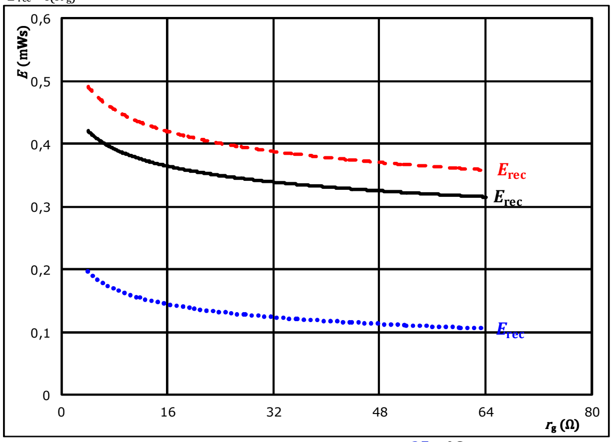
With an inductive load at

V_{CE} =	350	V	T_j: 25 °C	···········
V_{GE} =	±15	V	T_j: 125 °C	———
R_{gon} =	16	Ω	T_j: 150 °C	– – –

figure 4. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

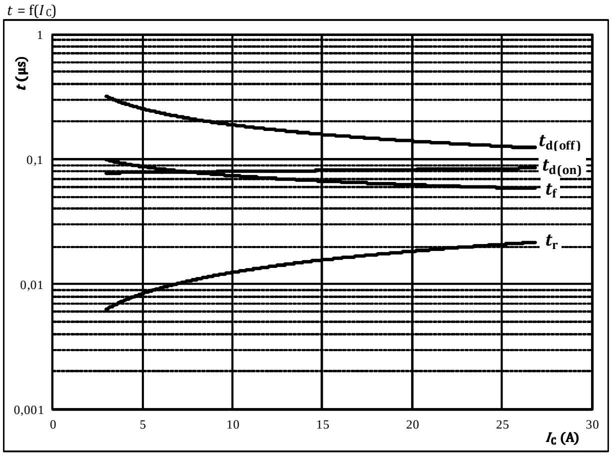
V_{CE} =	350	V	T_j: 25 °C	···········
V_{GE} =	±15	V	T_j: 125 °C	———
I_C =	15	A	T_j: 150 °C	– – –

Neutral Point Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



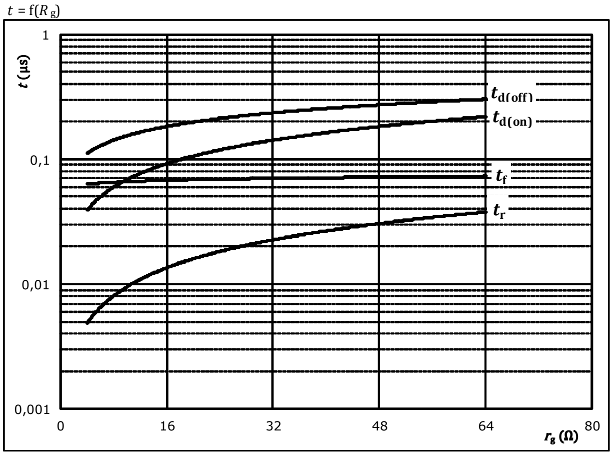
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 6. IGBT

Typical switching times as a function of gate resistor

$t = f(R_g)$



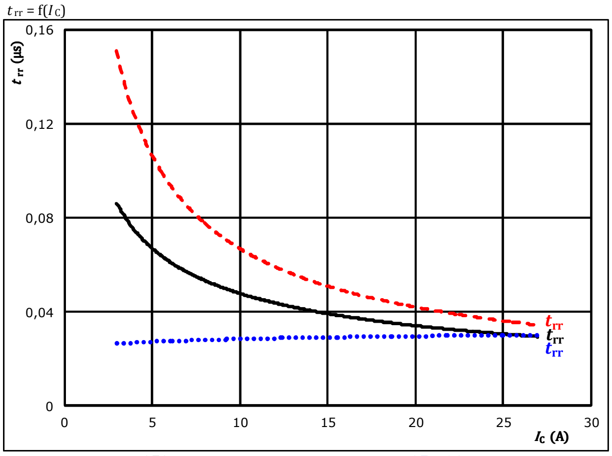
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	15	A

figure 7. FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

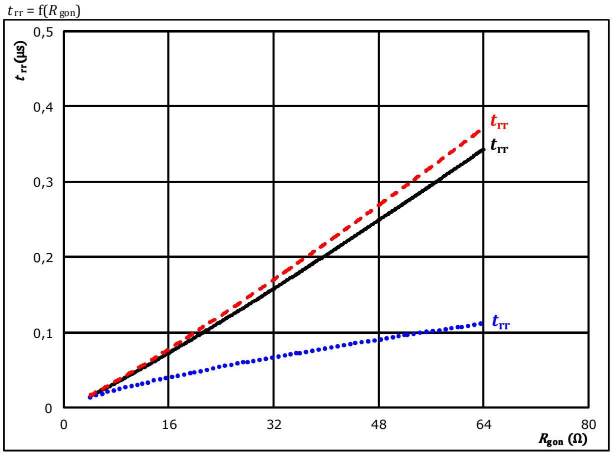


At					
V_{CE} =	350	V		25 °C	dotted (blue)
V_{GE} =	±15	V	T_j:	125 °C	solid (black)
R_{gon} =	16	Ω		150 °C	dashed (red)

figure 8. FWD

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

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



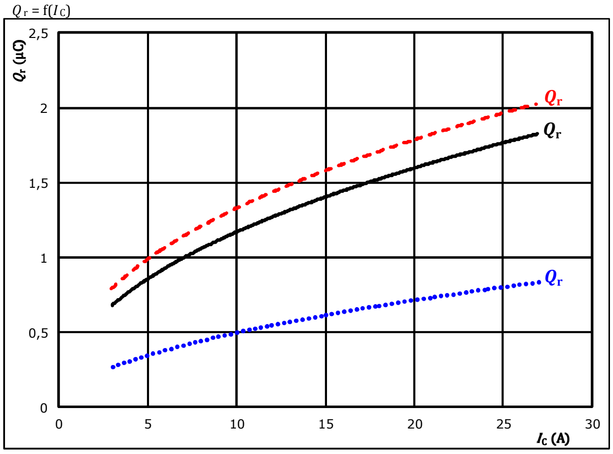
At					
V_{CE} =	350	V		25 °C	dotted (blue)
V_{GE} =	±15	V	T_j:	125 °C	solid (black)
I_C =	15	A		150 °C	dashed (red)

Neutral Point Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

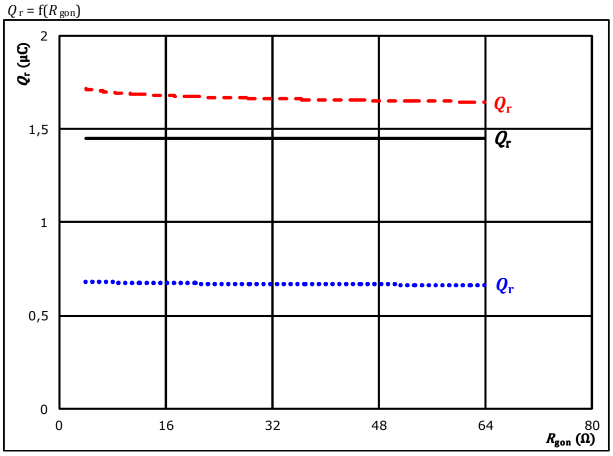


At						
	V_{CE} =	350	V		25 °C	....
	V_{GE} =	±15	V	T_j:	125 °C	———
	R_{gon} =	16	Ω		150 °C	– – –

figure 10. **FWD**

Typical recoved charge as a function of IGBT turn on gate resistor

$Q_r = f(R_{gon})$

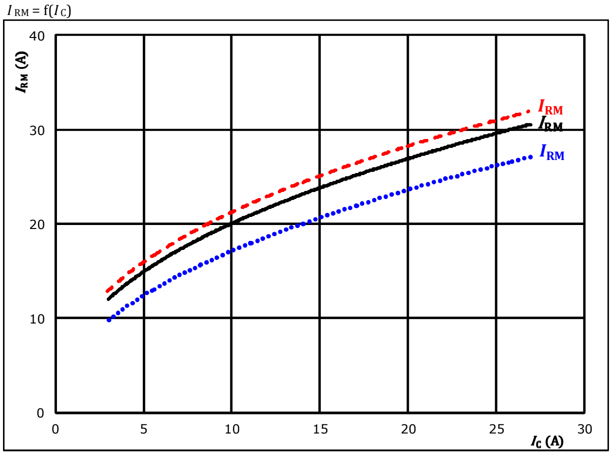


At						
	V_{CE}=	350	V		25 °C	....
	V_{GE} =	±15	V	T_j:	125 °C	———
	I_C=	15	A		150 °C	– – –

figure 11. **FWD**

Typical peak reverse recovery current current as a function of collector current

$I_{RM} = f(I_C)$

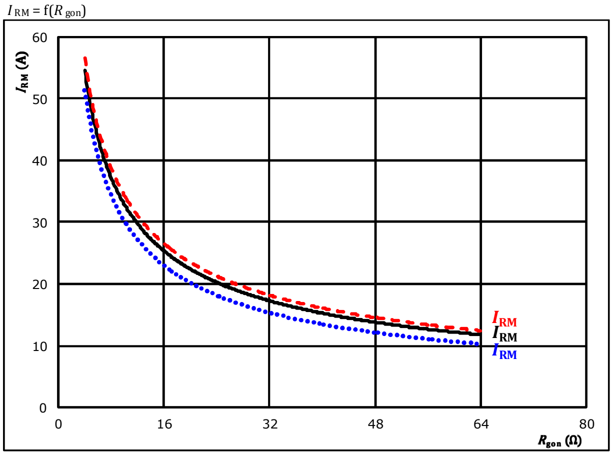


At						
	V_{CE} =	350	V		25 °C	....
	V_{GE} =	±15	V	T_j:	125 °C	———
	R_{gon} =	16	Ω		150 °C	– – –

figure 12. **FWD**

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

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



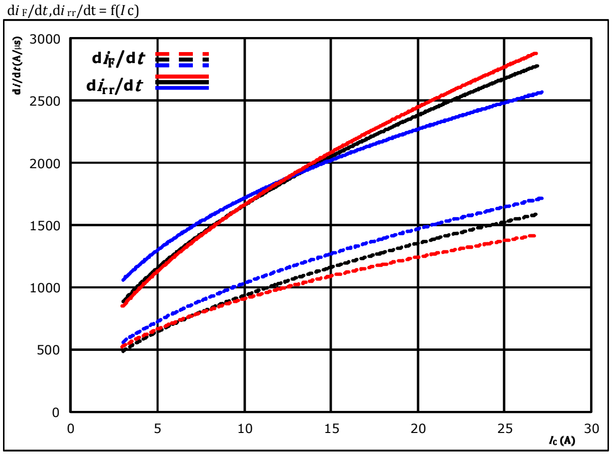
At						
	V_{CE} =	350	V		25 °C	....
	V_{GE} =	±15	V	T_j:	125 °C	———
	I_C =	15	A		150 °C	– – –

Neutral Point Switching Characteristics

figure 13. **FWD**

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

$di_F/dt, di_{rr}/dt = f(I_C)$

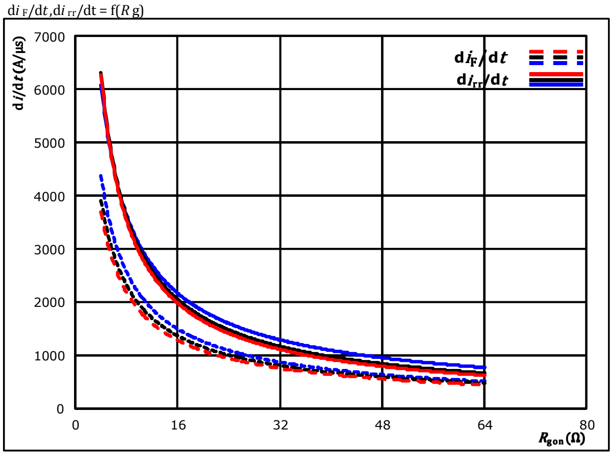


At					
V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
R_{gon} =	16	Ω		150 °C	dashed

figure 14. **FWD**

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

$di_F/dt, di_{rr}/dt = f(R_g)$

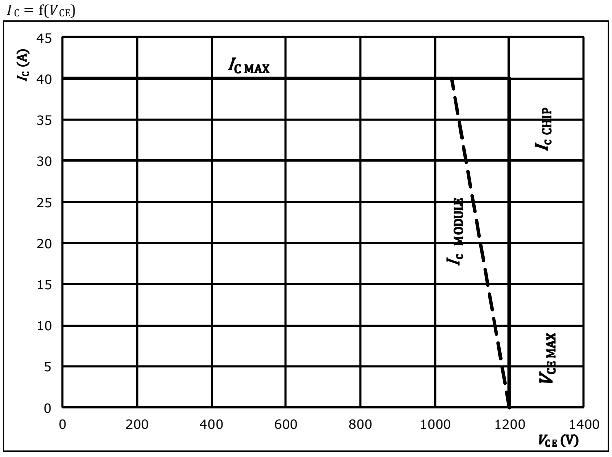


At					
V_{CE} =	350	V	T_j:	25 °C	dotted
V_{GE} =	±15	V		125 °C	solid
I_C =	15	A		150 °C	dashed

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At		
T_j =	175	°C
R_{gon} =	16	Ω
R_{goff} =	16	Ω

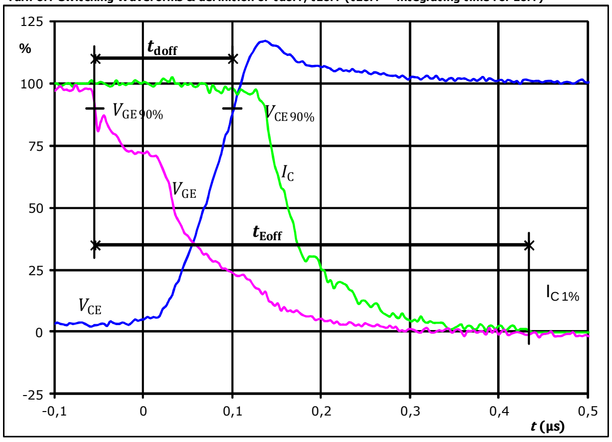
Neutral Point Switching Definitions

General conditions

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

figure 1. IGBT

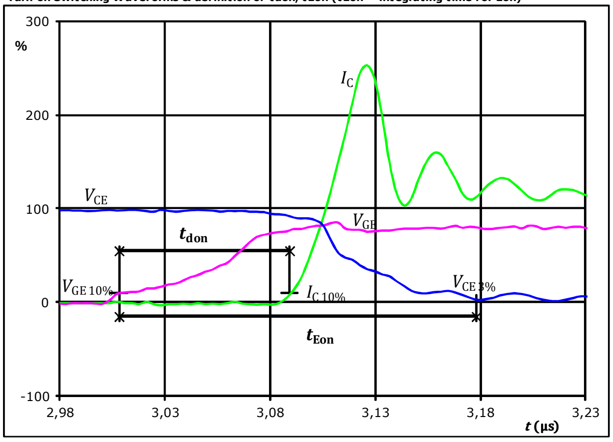
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	15	A
t_{doff} =	0,155	µs
t_{Eoff} =	0,488	µs

figure 2. IGBT

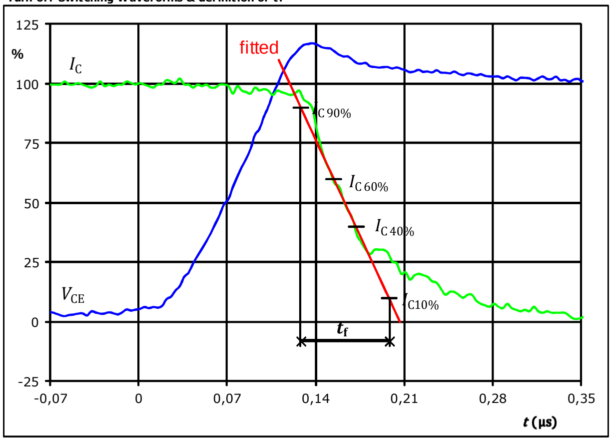
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	15	A
t_{don} =	0,080	µs
t_{Eon} =	0,170	µs

figure 3. IGBT

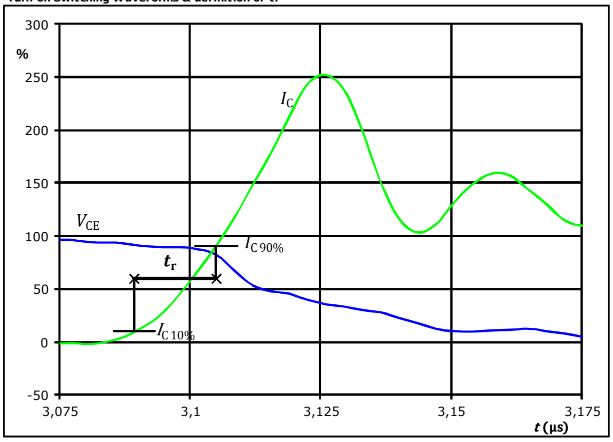
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	15	A
t_f =	0,071	µs

figure 4. IGBT

Turn-on Switching Waveforms & definition of tr

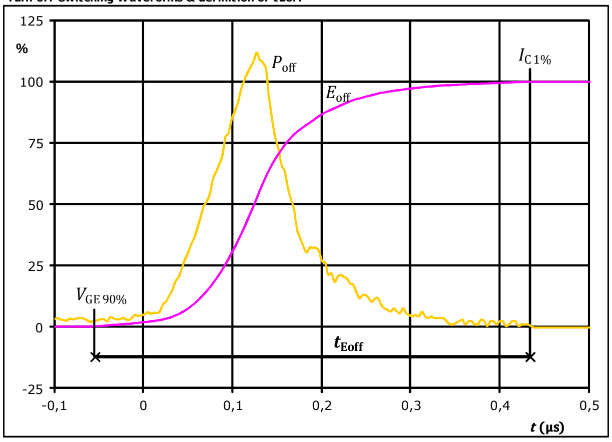


$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	15	A
t_r =	0,016	µs

Neutral Point Switching Characteristics

figure 5. IGBT

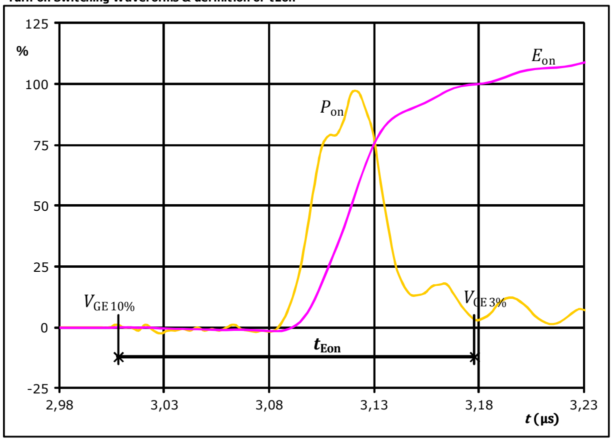
Turn-off Switching Waveforms & definition of tEoff



P_{off} (100%) =	5,25	kW
E_{off} (100%) =	0,58	mJ
t_{Eoff} =	0,49	µs

figure 6. IGBT

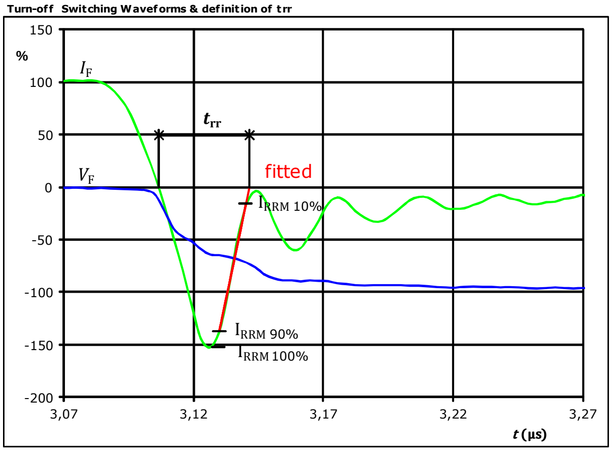
Turn-on Switching Waveforms & definition of tEon



P_{on} (100%) =	5,25	kW
E_{on} (100%) =	0,34	mJ
t_{Eon} =	0,17	µs

figure 7. FWD

Turn-off Switching Waveforms & definition of trr

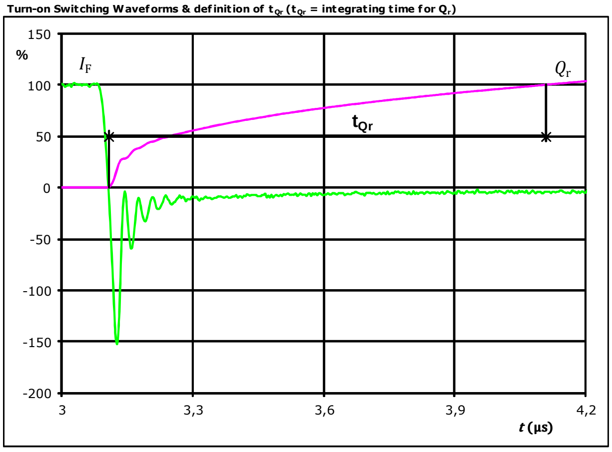


V_F (100%) =	350	V
I_F (100%) =	15	A
I_{RRM} (100%) =	-23	A
t_{rr} =	0,035	µs

Neutral Point Switching Characteristics

figure 8. **FWD**

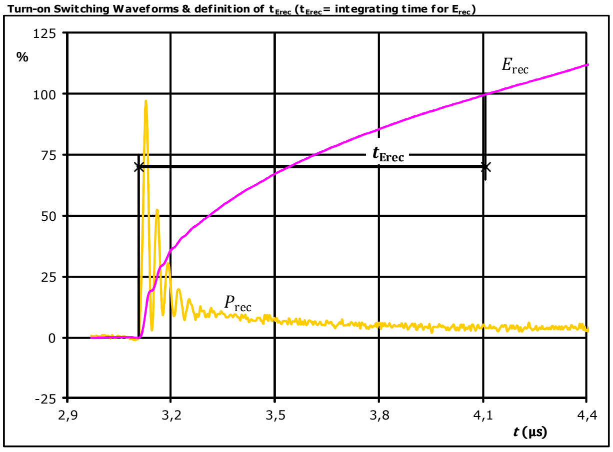
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	15	A
Q_r (100%) =	1,31	µC
t_{Qr} =	1,00	µs

figure 9. **FWD**

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



P_{rec} (100%) =	5,25	kW
E_{rec} (100%) =	0,32	mJ
t_{Erec} =	1,00	µs

Ordering Code & Marking

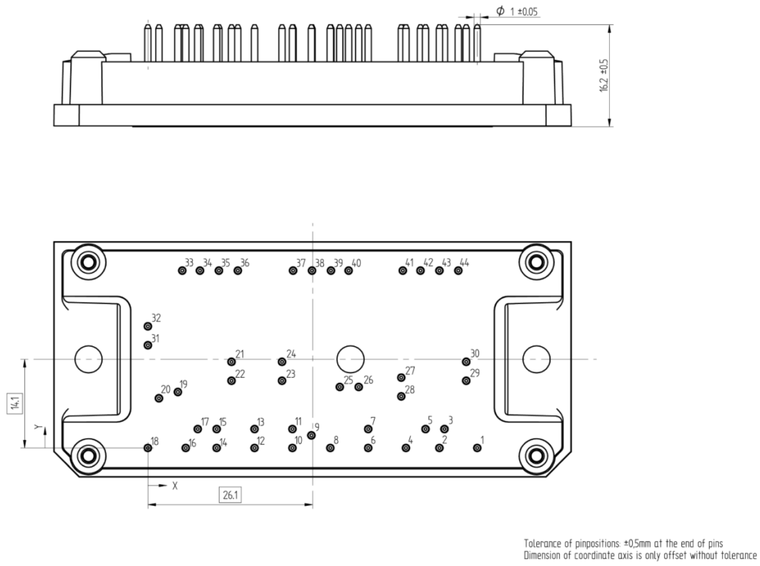
Version	Ordering Code
with thermal paste 12 mm housing with solder pins	10-FY12M3A025SH03-M746F48-/3/
with thermal paste 12 mm housing with press-fit pins	10-PY12M3A025SH03-M746F48Y-/3/

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

10-FY12M3A025SH03-M746F48-/3/

Outline

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

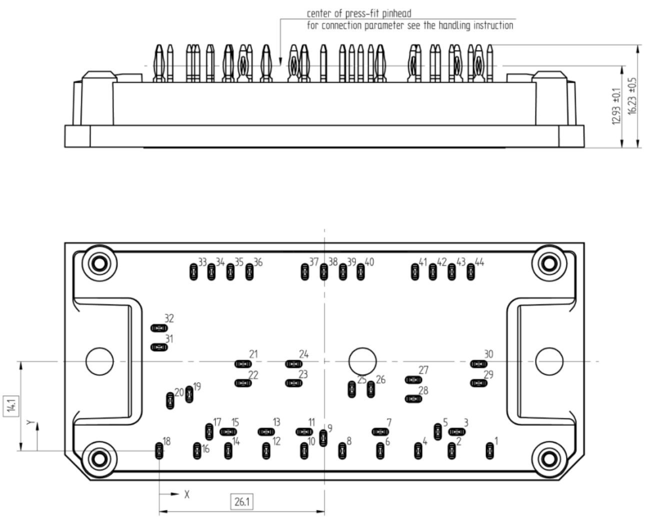


10-PY12M3A025SH03-M746F48Y-/3/

Outline

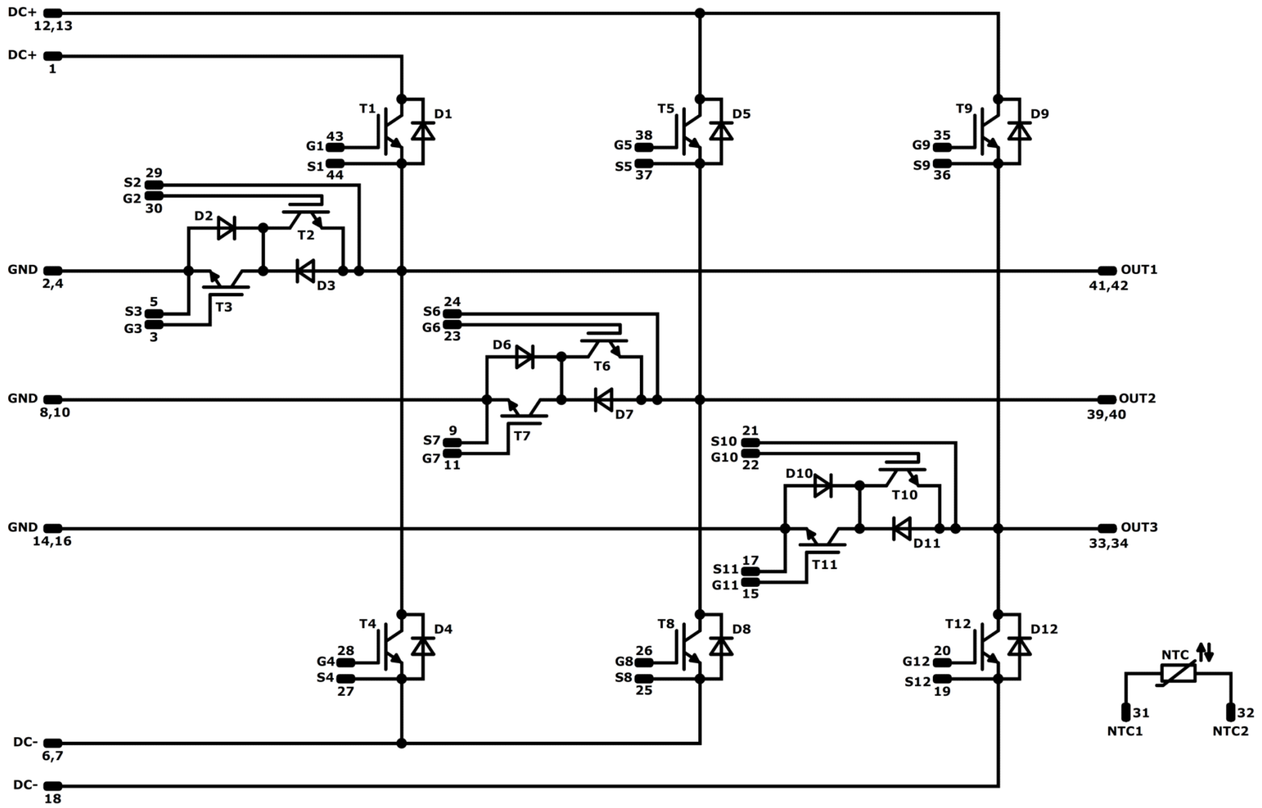
Pin table [mm]			
Pin	X	Y	Function
1	52,2	0	+DC
2	46,2	0	GND
3	47	3	G3
4	40,9	0	GND
5	44	3	S3
6	34,9	0	-DC
7	34,9	3	-DC
8	28,9	0	GND
9	25,9	2	S7
10	22,9	0	GND
11	22,9	3	G7
12	16,9	0	+DC
13	16,9	3	+DC
14	10,9	0	GND
15	10,9	3	G11
16	6	0	GND
17	7,9	3	S11
18	0	0	-DC
19	4,75	8,9	S12
20	1,75	7,9	G12
21	13,25	13,7	S10
22	13,25	10,7	G10
23	21,25	10,7	G6
24	21,25	13,7	S6
25	30,4	9,7	S8
26	33,4	9,7	G8
27	40,15	11,2	S4
28	40,15	8,2	G4
29	50,45	10,7	S2

Pin table [mm]			
Pin	X	Y	Function
30	50,45	13,7	G2
31	0	16,35	NTC
32	0	19,35	NTC
33	5,45	28,2	OUT3
34	8,25	28,2	OUT3
35	11,25	28,2	G9
36	14,25	28,2	S9
37	23	28,2	S5
38	26	28,2	G5
39	29	28,2	OUT2
40	31,8	28,2	OUT2
41	40,4	28,2	OUT1
42	43,2	28,2	OUT1
43	46,2	28,2	G1
44	49,2	28,2	S1



Tolerance of pinpositions ±0,5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1,T4,T5,T8,T9,T12	IGBT	1200 V	25 A	Half Bridge Switch	
D2,D3,D6,D7,D10,D11	FWD	650 V	20 A	Neutral Point Diode	
T2,T3,T6,T7,T10,T11	IGBT	650 V	20 A	Neutral Point Switch	
D1,D4,D5,D8,D9,D12	FWD	1200 V	8 A	Half Bridge Diode	
NTC	Thermistor			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-xY12M3A025SH03-M746F48x-D1-14	31 Jan. 2017		

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