Vincotech

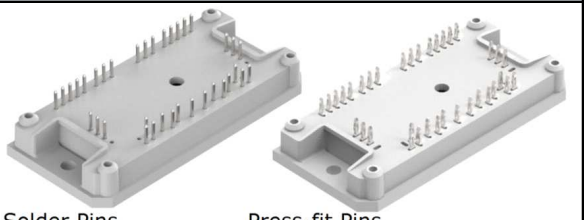
10-FY124PA080SH-L589F48
10-PY124PA080SH-L589F48Y
datasheet

fastPACK 1 H — **1200 V / 80 A**

Features

- High speed IGBT
- Fast, soft reverse Diode
- Open emitter topology
- Integrated thermistor

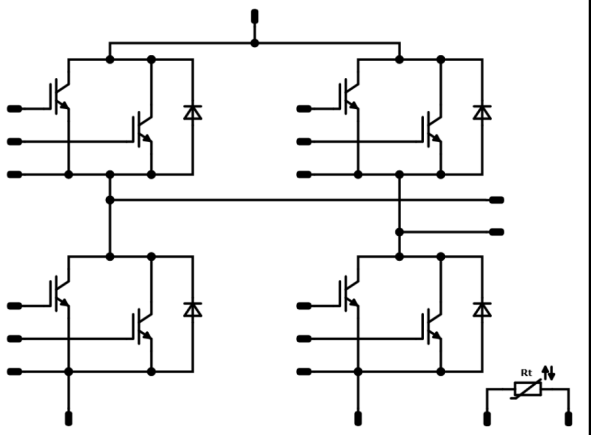
flow 1 12 mm housing



Target applications

- Charger
- SMPS
- Solar
- Welding
- ESS

Schematic



Types

- 10-FY124PA080SH-L589F48
- 10-PY124PA080SH-L589F48Y

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
H-Bridge Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	T_j = T_{jmax} T_s = 80 °C	71	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	240	A
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	166	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
H-Bridge Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	46	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms T_j = 150 °C	270	A
Surge current capability	I^2t		365	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	98	W
Maximum Junction Temperature	T_{jmax}		175	°C
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	6000	V
		AC Voltage t_p = 1 min	2500	mm
Creepage distance			min. 12,7	mm
Clearance		with solder pins / with press-fit pins	8,1 / 7,92	mm
Comparative Tracking Index	CTI		> 200	

*100 % tested in production

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	
H-Bridge Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,003	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		80	25 125 150	1,78	1,99 2,33 2,41	2,42	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			10	µA
Gate-emitter leakage current	I_{GES}		20	0		25			240	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f= 1MHz	0	25		25		4660		pF
Output capacitance	C_{oes}							300		
Reverse transfer capacitance	C_{res}							260		
Gate charge	Q_g		15	960	80	25		370		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,57		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 4 Ω R_{gon} = 4 Ω	±15	600	80	25 125 150		72 73 73		ns
Rise time	t_r					25 125 150		11 13 13		
Turn-off delay time	$t_{d(off)}$					25 125 150		179 233 248		
Fall time	t_f					25 125 150		35 78 93		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 6,4 µC Q_{rFWD} = 10,7 µC Q_{rFWD} = 12,7 µC				25 125 150		1,705 2,633 3,049		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		3,358 5,377 5,997		

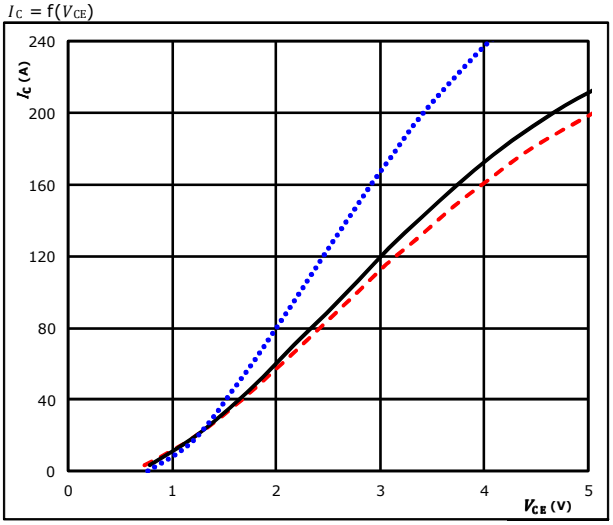
Characteristic Values

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	
H-Bridge Diode										
Static										
Forward voltage	V_F				50	25 150		2,19 2,21	2,54	V
Reverse leakage current	I_r			1200		25 150			60 8800	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,97		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 10206 A/µs di/dt = 7449 A/µs di/dt = 7007 A/µs	±15	600	80	25 125 150		165 194 204		A
Reverse recovery time	t_{rr}					25 125 150		35 101 123		ns
Recovered charge	Q_r					25 125 150		6,382 10,712 12,685		µC
Reverse recovered energy	E_{rec}					25 125 150		3,059 5,172 6,086		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		8909 8599 9104		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	

H-Bridge Switch Characteristics

Typical output characteristics **IGBT**

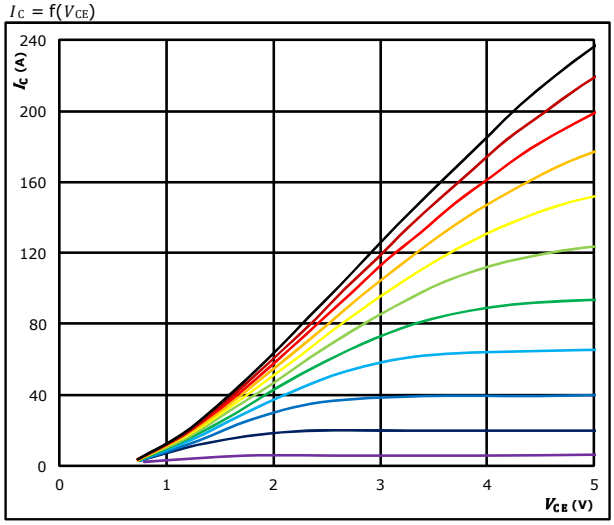
$I_C = f(V_{CE})$



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

Typical output characteristics **IGBT**

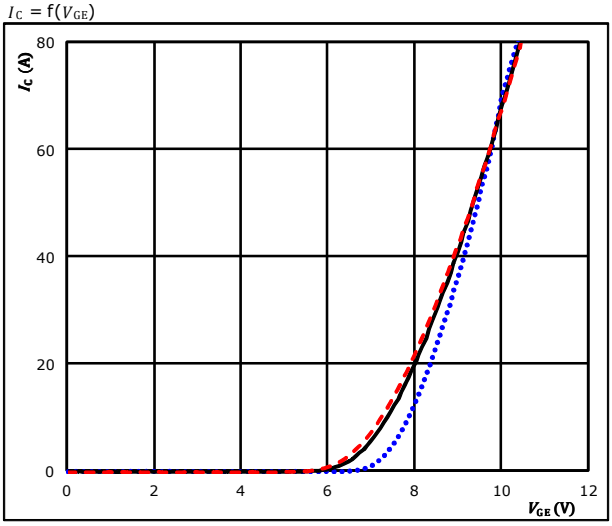
$I_C = f(V_{CE})$



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

Typical transfer characteristics **IGBT**

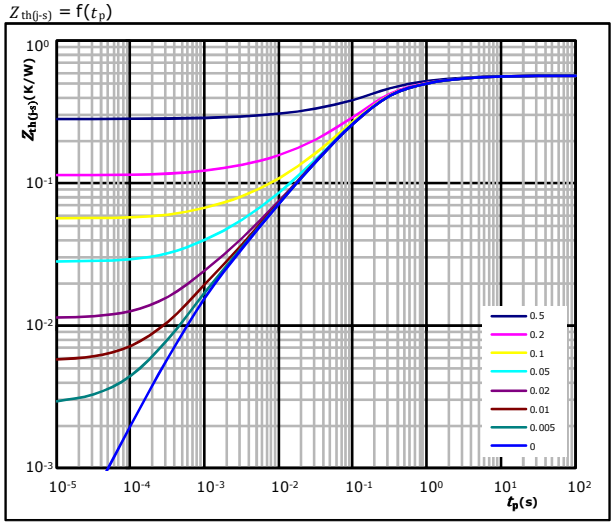
$I_C = f(V_{GE})$



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

Transient Thermal Impedance as function of Pulse duration **IGBT**

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,57	K/W

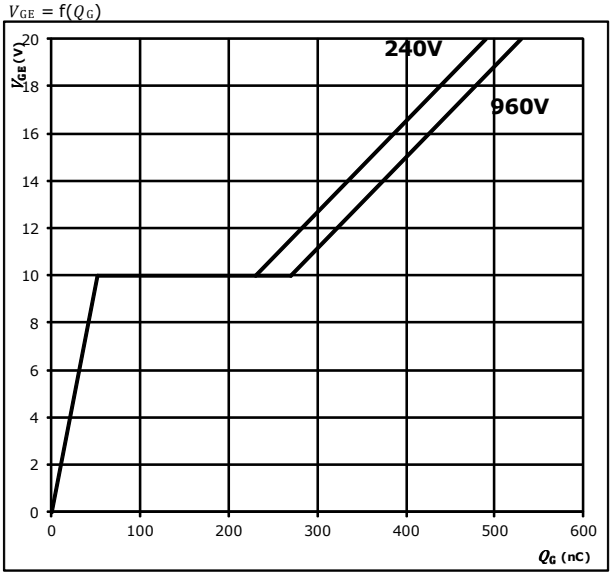
IGBT thermal model values

R (K/W)	τ (s)
3,82E-02	4,84E+00
1,01E-01	9,05E-01
3,13E-01	1,69E-01
7,11E-02	3,95E-02
3,50E-02	8,21E-03
1,29E-02	9,97E-04

H-Bridge Switch Characteristics

Gate voltage vs Gate charge **IGBT**

$V_{GE} = f(Q_G)$

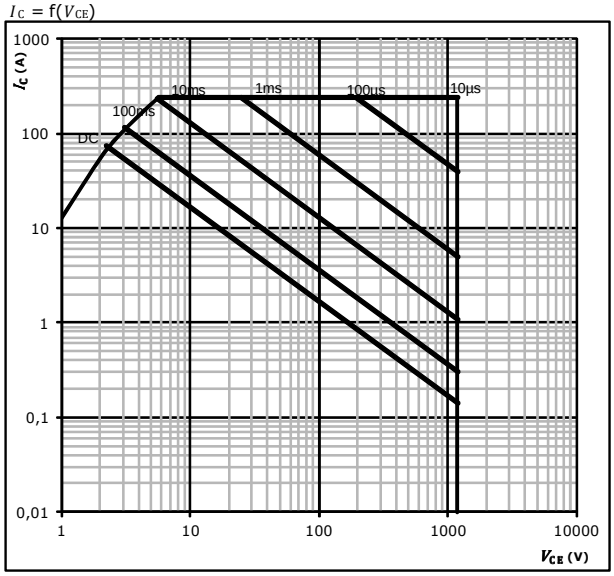


At

I_C= 80 A

Safe operating area **IGBT**

$I_C = f(V_{CE})$

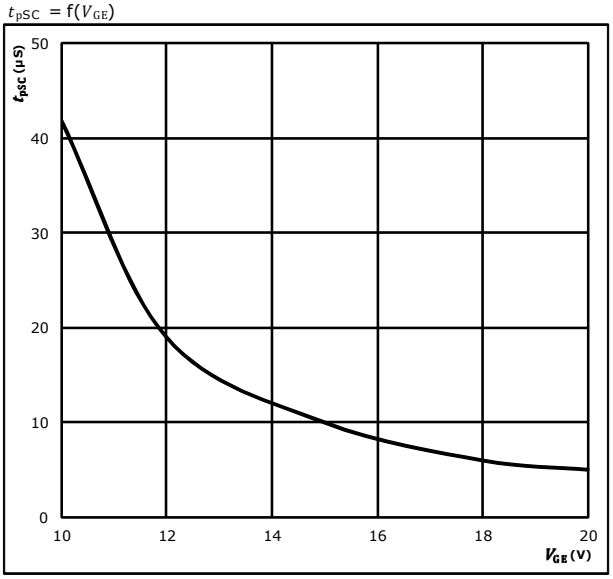


At

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

Short circuit duration as a function of V_{GE} **IGBT**

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

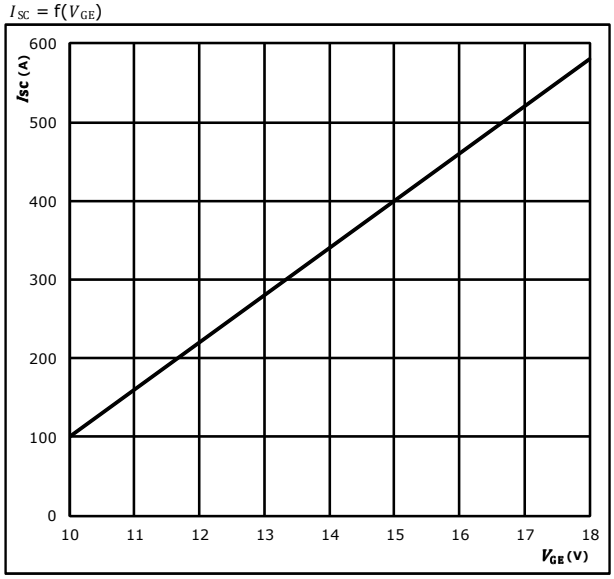


At

V_{CE} = 600 V
T_j ≤ 150 °C

Typical short circuit current as a function of V_{GE} **IGBT**

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



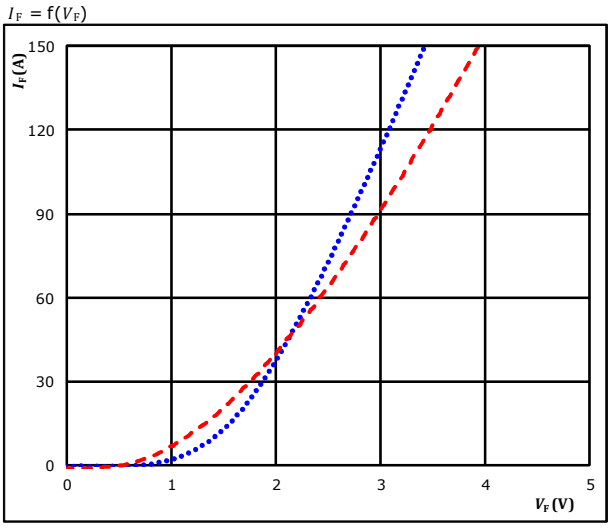
At

V_{CE} ≤ 600 V
T_j ≤ 25 °C

H-Bridge Diode Characteristics

figure 1. **FWD**

Typical forward characteristics



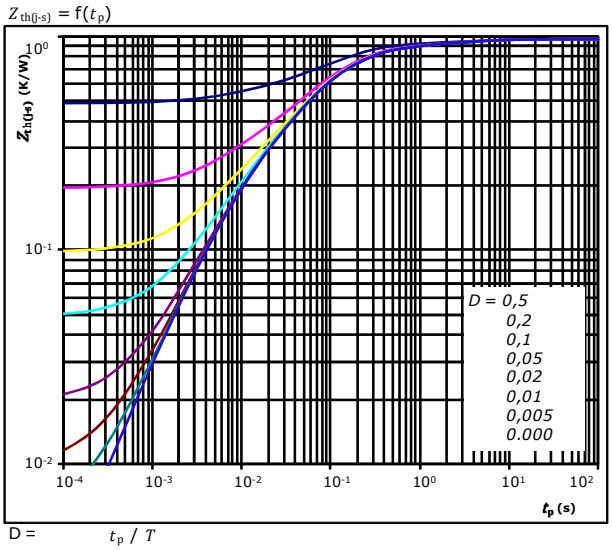
t_p = 250 µs

T_j: 25 °C

150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width



D = t_p / T

$R_{th(j-s)}$ = 0,97 K/W

FWD thermal model values

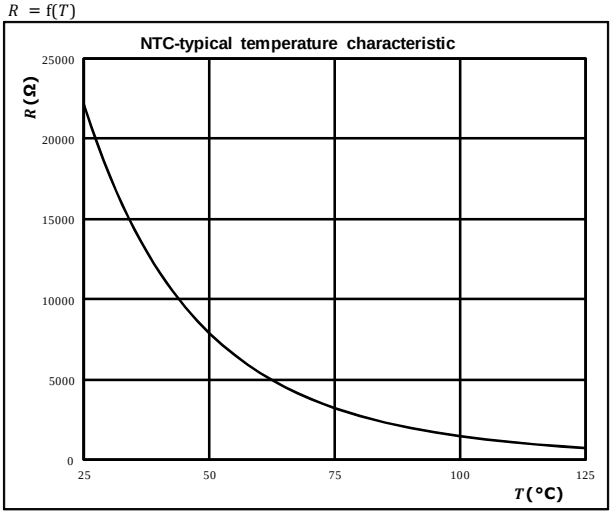
R (K/W)	τ (s)
6,6890E-02	3,8680E+00
1,4690E-01	4,6800E-01
4,9550E-01	9,1220E-02
1,7380E-01	2,2610E-02
8,7450E-02	5,0060E-03

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic as a function of temperature

$R = f(T)$

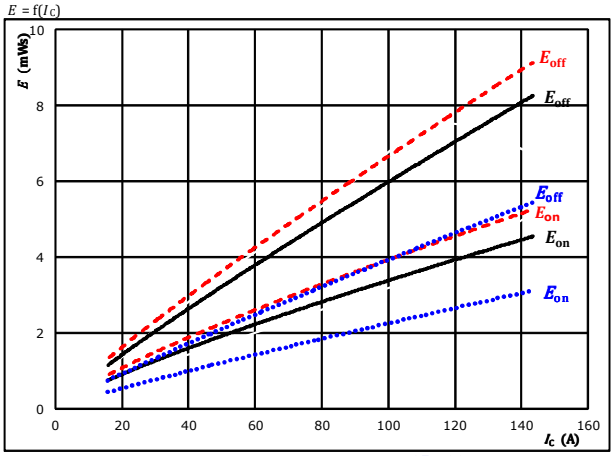


H-Bridge Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



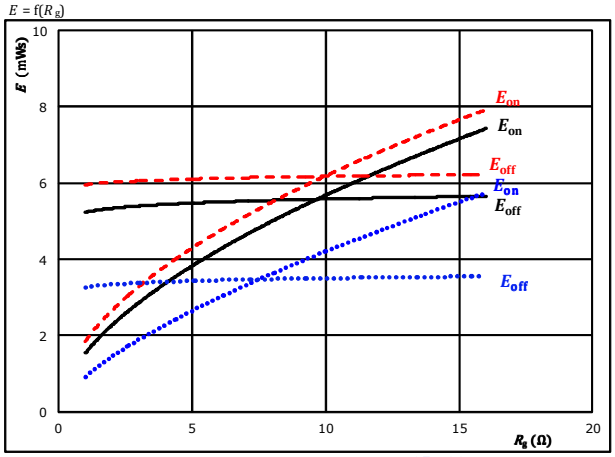
With an inductive load at

V_{CE} =	600	V	T_J:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	4	Ω		150 °C
R_{goff} =	4	Ω		

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



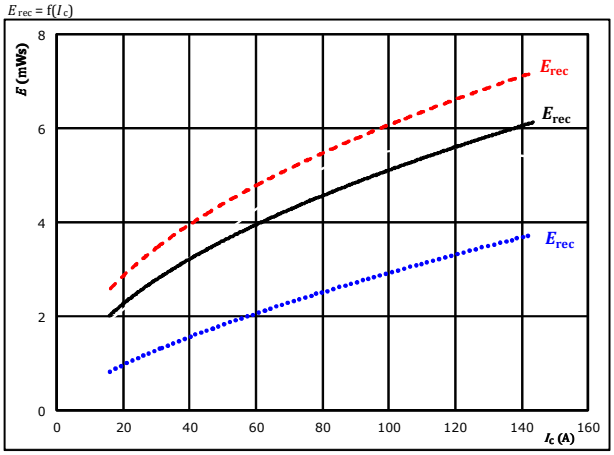
With an inductive load at

V_{CE} =	600	V	T_J:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	80	A		150 °C

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



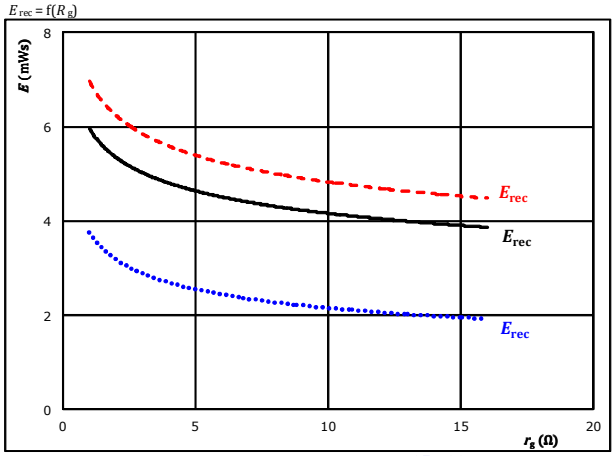
With an inductive load at

V_{CE} =	600	V	T_J:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	4	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

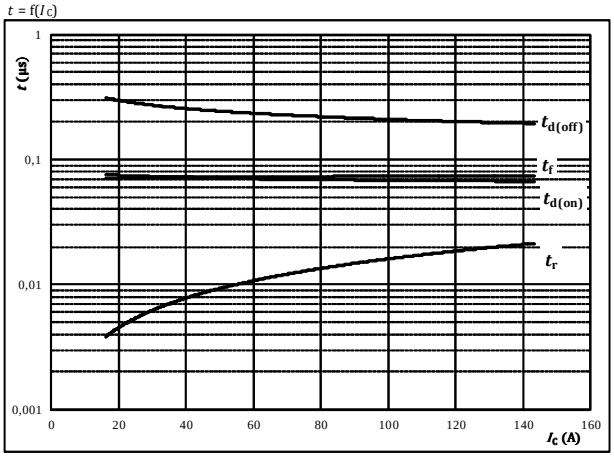
V_{CE} =	600	V	T_J:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	80	A		150 °C

H-Bridge Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



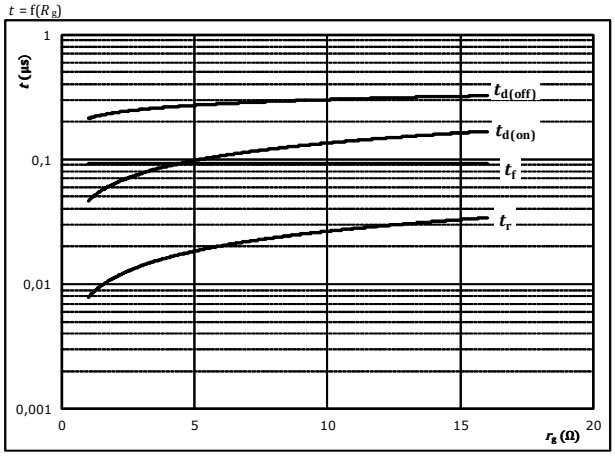
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



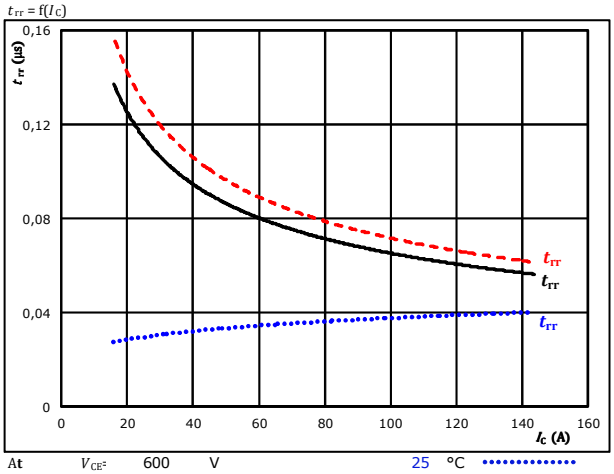
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	80	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

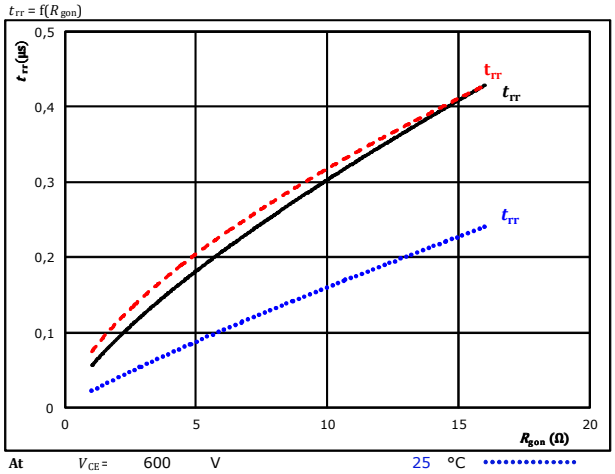


At					
V_{CE} =	600	V	T_j:	25	°C
V_{GE} =	±15	V		125	°C
R_{gon} =	4	Ω		150	°C

figure 8. **FWD**

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

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



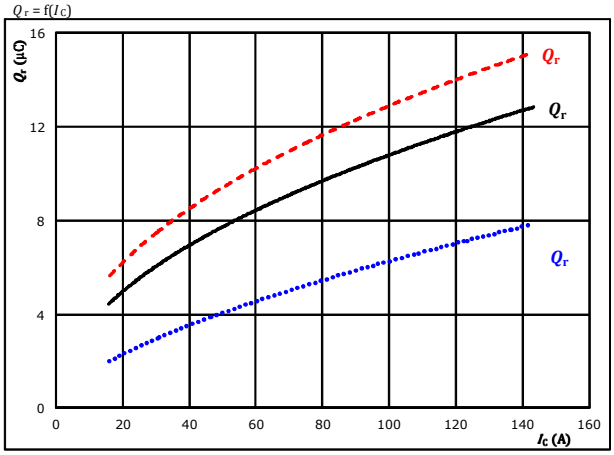
At					
V_{CE} =	600	V	T_j:	25	°C
V_{GE} =	±15	V		125	°C
I_C =	80	A		150	°C

H-Bridge Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

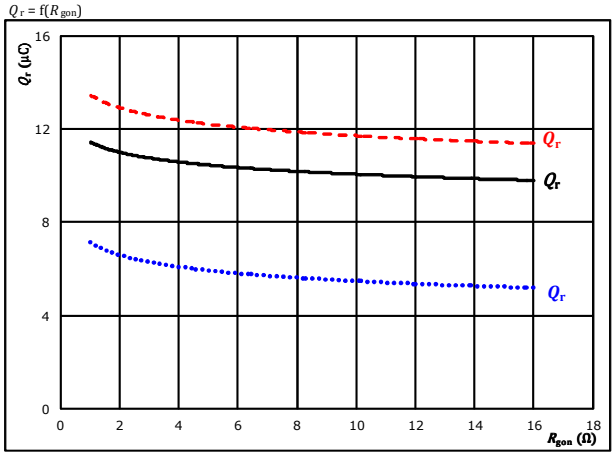


At						
	V_{CE} =	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	R_{gon} =	4	Ω		150 °C	

figure 10. FWD

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

$Q_r = f(R_{gon})$

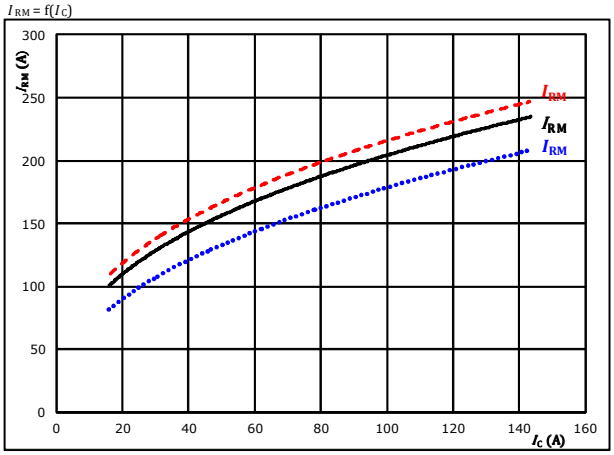


At						
	V_{CE}=	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	I_C=	80	A		150 °C	

figure 11. FWD

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

$I_{RM} = f(I_C)$

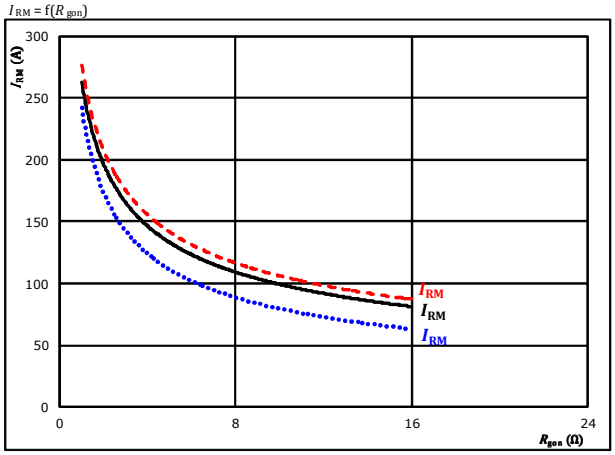


At						
	V_{CE}:	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	R_{gon} =	4	Ω		150 °C	

figure 12. FWD

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

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



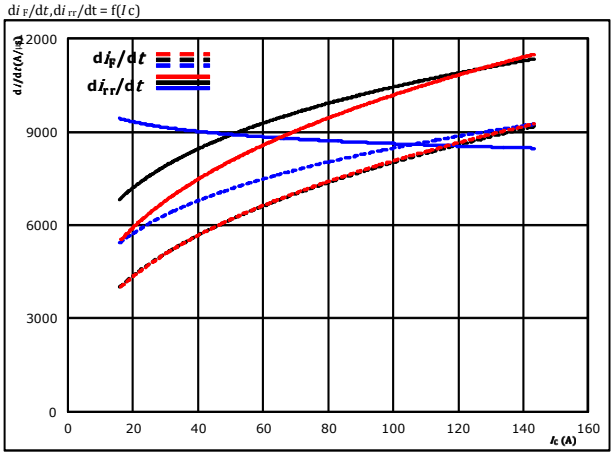
At						
	V_{CE} =	600	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	I_C =	80	A		150 °C	

H-Bridge Switching Characteristics

figure 13. **FWD**

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

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

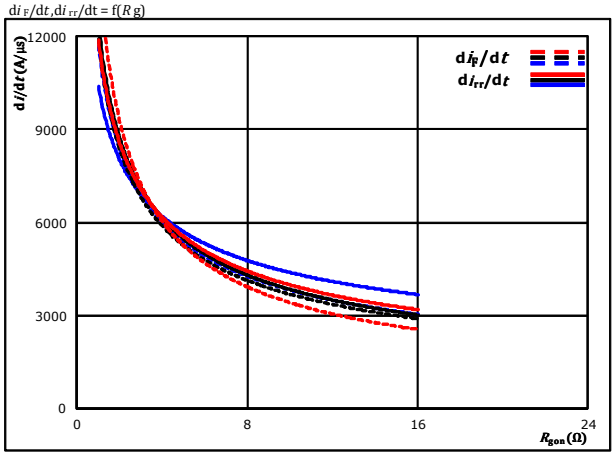


At						
V_{CE} =	600	V	T_j:	25 °C	•••••••••••••••
V_{GE} =	±15	V		125 °C	———
R_{gon} =	4	Ω		150 °C	– – – –

figure 14. **FWD**

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

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

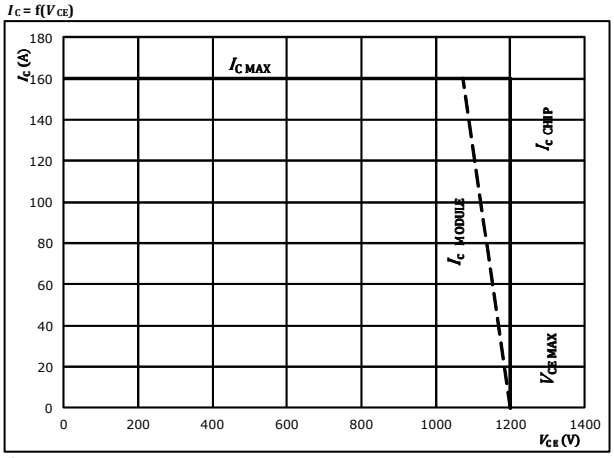


At						
V_{CE} =	600	V	T_j:	25 °C	•••••••••••••••
V_{GE} =	±15	V		125 °C	———
I_C =	80	A		150 °C	– – – –

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	175	°C
R_{gon} =	4	Ω
R_{goff} =	4	Ω

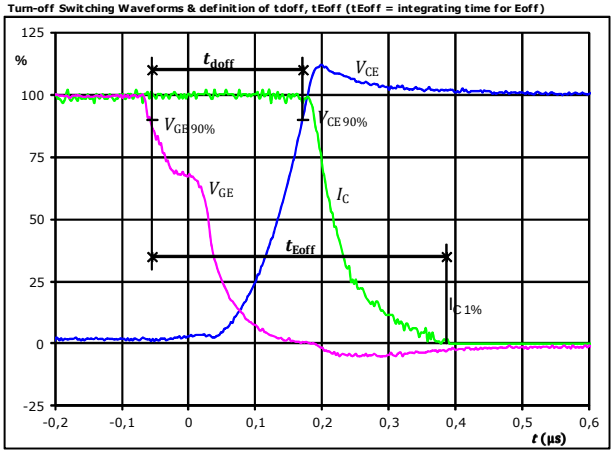
H-Bridge Switching Definitions

General conditions

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

figure 1. **IGBT**

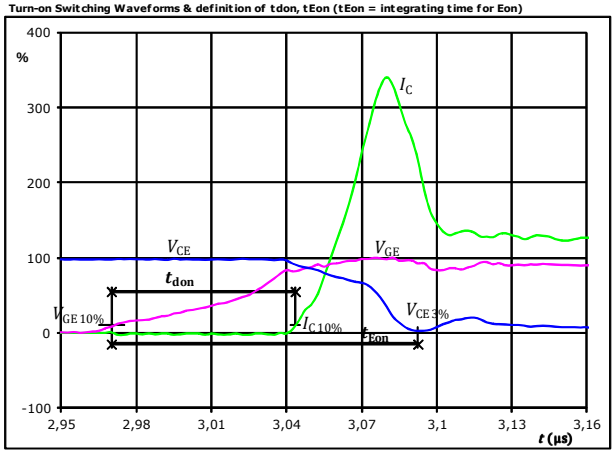
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	80	A
t_{doff} =	0,233	µs
t_{Eoff} =	0,441	µs

figure 2. **IGBT**

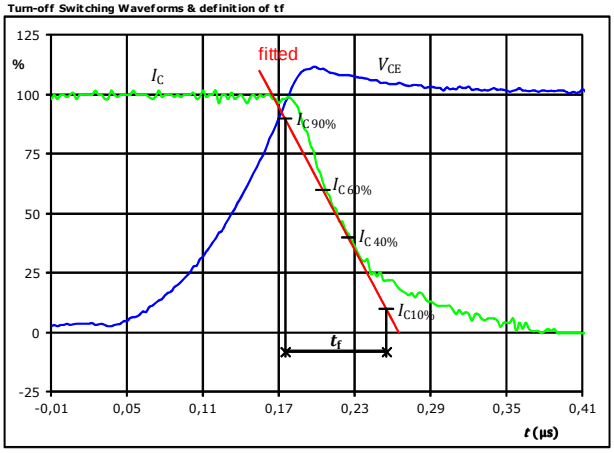
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	80	A
t_{don} =	0,073	µs
t_{Eon} =	0,122	µs

figure 3. **IGBT**

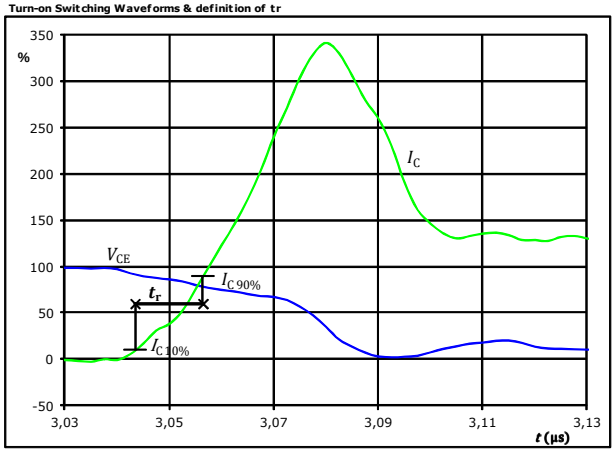
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	80	A
t_f =	0,078	µs

figure 4. **IGBT**

Turn-on Switching Waveforms & definition of tr

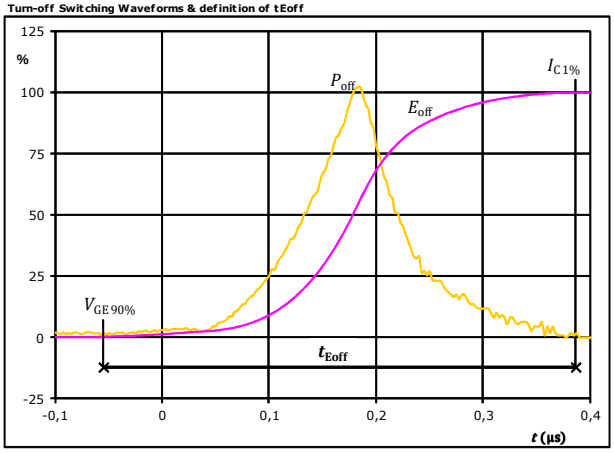


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	80	A
t_r =	0,013	µs

H-Bridge Switching Characteristics

figure 5. **IGBT**

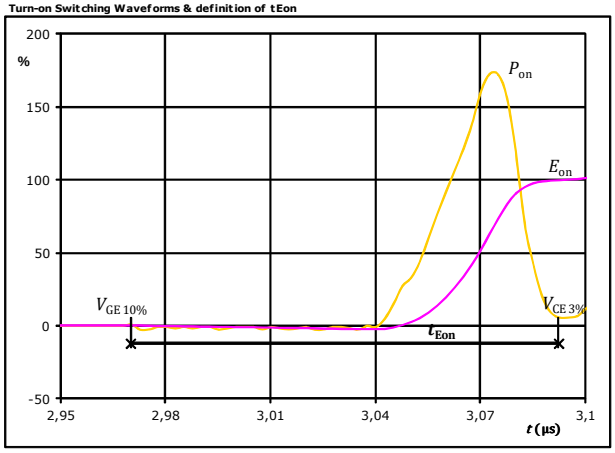
Turn-off Switching Waveforms & definition of tEoff



$P_{off}(100\%) =$	48,22	kW
$E_{off}(100\%) =$	5,38	mJ
$t_{Eoff} =$	0,44	µs

figure 6. **IGBT**

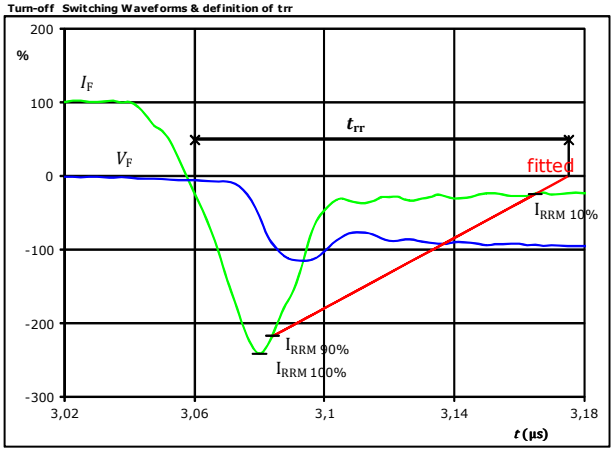
Turn-on Switching Waveforms & definition of tEon



$P_{on}(100\%) =$	48,22	kW
$E_{on}(100\%) =$	2,63	mJ
$t_{Eon} =$	0,12	µs

figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr

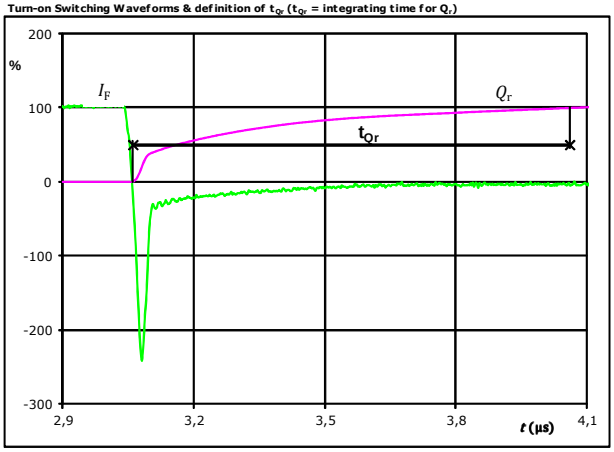


$V_F(100\%) =$	600	V
$I_F(100\%) =$	80	A
$I_{RRM}(100\%) =$	-194	A
$t_{rr} =$	0,101	µs

H-Bridge Switching Characteristics

figure 8. **FWD**

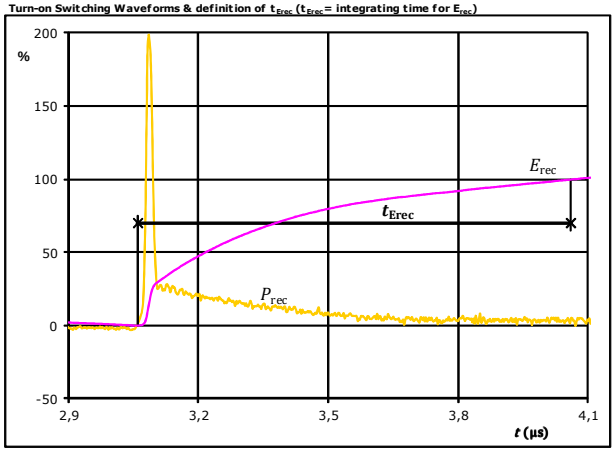
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	80	A
Q_r (100%) =	10,71	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%) =	48,22	kW
E_{rec} (100%) =	5,17	mJ
t_{Erec} =	1,00	µs

Vincotech

10-FY124PA080SH-L589F48
10-PY124PA080SH-L589F48Y
datasheet

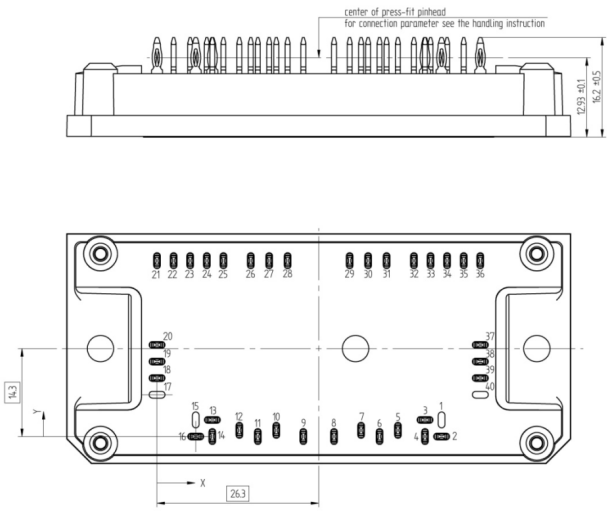
Ordering Code & Marking

Version	Ordering Code
without thermal paste 12 mm housing with solder pins	10-FY124PA080SH-L589F48
without thermal paste 12 mm housing with press-fit pins	10-PY124PA080SH-L589F48Y

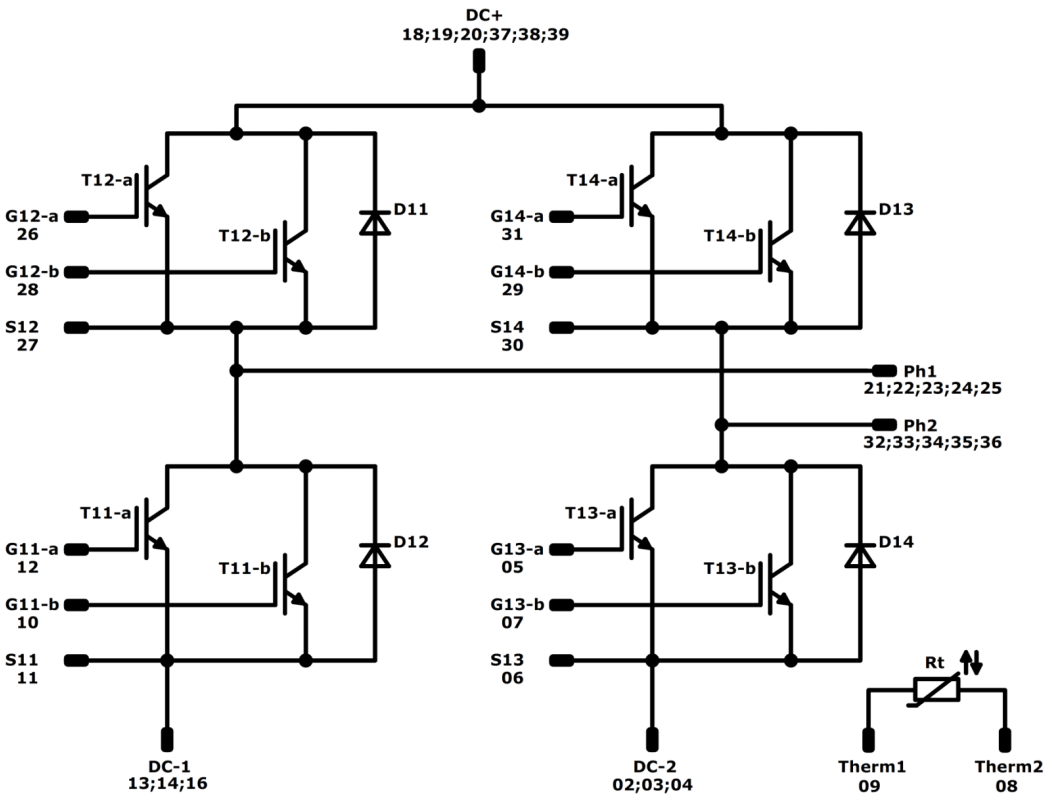
		Name		Date code	UL & VIN	Lot	Serial
Text		NN-NNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
	Type&Ver	**Lot number**	**Serial**	**Date code**			
Datamatrix	TTTTTTTVV	LLLLL	SSSS	WWYY			

Outline

Pin table [mm]				Pin table [mm]			
Pin	X	Y	Function	Pin	X	Y	Function
1	Not assembled			30	34,35	28,6	S14
2	46,3	0	DC-2	31	37,35	28,6	G14-a
3	43,6	2,7	DC-2	32	41,8	28,6	Ph2
4	43,6	0	DC-2	33	44,5	28,6	Ph2
5	39,2	1	G13-a	34	47,2	28,6	Ph2
6	36,2	0	S13	35	49,9	28,6	Ph2
7	33,2	1	G13-b	36	52,6	28,6	Ph2
8	28,8	0	Therm2	37	52,6	14,9	DC+
9	23,8	0	Therm1	38	52,6	12,2	DC+
10	19,4	1	G11-b	39	52,6	9,5	DC+
11	16,4	0	S11	40	Not assembled		
12	13,4	1	G11-a				
13	9	2,7	DC-1				
14	9	0	DC-1				
15	Not assembled						
16	6,3	0	DC-1				
17	Not assembled						
18	0	9,5	DC+				
19	0	12,2	DC+				
20	0	14,9	DC+				
21	0	28,6	Ph1				
22	2,7	28,6	Ph1				
23	5,4	28,6	Ph1				
24	8,1	28,6	Ph1				
25	10,8	28,6	Ph1				
26	15,25	28,6	G12-a				
27	18,25	28,6	S12				
28	21,25	28,6	G12-b				
29	31,35	28,6	G14-b				



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11a, T11b, T12a, T12b, T13a, T13b, T14a, T14b	IGBT	1200 V	80 A	H-Bridge Switch	Parallel devices with separate control. Values apply to complete device.
D11, D12, D13, D14	FWD	1200 V	50 A	H-Bridge Diode	
Rt	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-xY124PA080SH-L589F48x-D2-14	30 Aug. 2017	Schematic correction	17