Vincotech

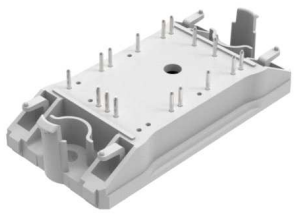
10-FZ071SA050SM02-L524L18
datasheet

flow **S-PFC 0** **650 V / 50 A**

Features

- Ultra fast IGBT and recovery boost diodes
- Integrated capacitor
- Temperature sensor

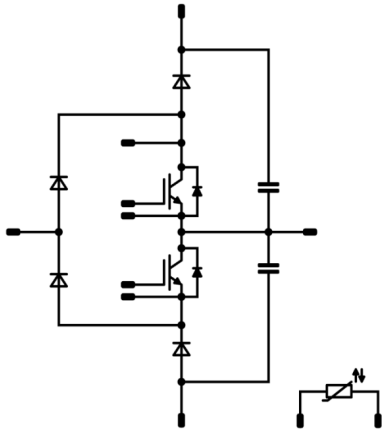
flow 0 12mm housing



Target applications

- Grid connected motor drive
- UPS
- Battery charger

Schematic



Types

- 10-FZ071SA050SM02-L524L18

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Boost Switch				
Collector-emitter voltage	V_{CES}		650	V
Collector current	I_C	$T_j = T_{jmax}$ T_s = 80 °C	43	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	150	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	84	W
Gate-emitter voltage	V_{GES}		±20	V
Maximum Junction Temperature	T_{jmax}		175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Boost Diode				
Peak repetitive reverse voltage	V_{RRM}		650	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	49	A
Repetitive peak forward current	I_{FRM}		100	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	68	W
Maximum junction temperature	T_{jmax}		175	°C
Boost Sw. Protection Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		650	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	17	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	33	W
Maximum Junction Temperature	T_{jmax}		175	°C
Rectifier Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		1600	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		370	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	56	W
Maximum Junction Temperature	T_{jmax}		150	°C
DC Link Capacitance				
Maximum DC voltage	V_{MAX}		630	V
Operation Temperature	T_{op}		-55…+125	°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			min. 12,7	mm
Clearance			9,75	mm
Comparative Tracking Index	CTI		> 200	

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	
Boost Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0005	25	3,3	4	4,7	V
Collector-emitter saturation voltage	V_{CEsat}		15		50	25 125		1,82 2,00	2,22	V
Collector-emitter cut-off current	I_{CES}		0	650		25			40	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		3000		pF
Output capacitance	C_{oes}							50		
Reverse transfer capacitance	C_{res}							11		
Gate charge	Q_g		15	520	50	25		120		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,13		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 8 Ω R_{gon} = 8 Ω	-5 / 15	350	50	25 125 150		35 36 36		ns
Rise time	t_r					25 125 150		9 11 11		
Turn-off delay time	$t_{d(off)}$					25 125 150		97 109 117		
Fall time	t_f					25 125 150		4 7 9		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 1,8 µC Q_{rFWD} = 3,3 µC Q_{rFWD} = 3,8 µC				25 125 150		1,028 1,159 1,278		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,238 0,394 0,437		

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	
Boost Diode										
Static										
Forward voltage	V_F				50	25 125		1,50 1,44	1,77	V
Reverse leakage current	I_R			650		25			2,65	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,41		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 4061 A/µs di/dt = 5418 A/µs di/dt = 3990 A/µs	-5 / 15	350	50	25 125 150		39 52 58		A
Reverse recovery time	t_{rr}					25 125 150		86 109 121		ns
Recovered charge	Q_r					25 125 150		1,787 3,294 3,823		µC
Reverse recovered energy	E_{rec}					25 125 150		0,346 0,699 0,831		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		301 451 472		A/µs
Boost Sw. Protection Diode										
Static										
Forward voltage	V_F				10	25 125		1,67 1,56	1,87	V
Reverse leakage current	I_r			650		25			0,14	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						2,87		K/W

Characteristic Values

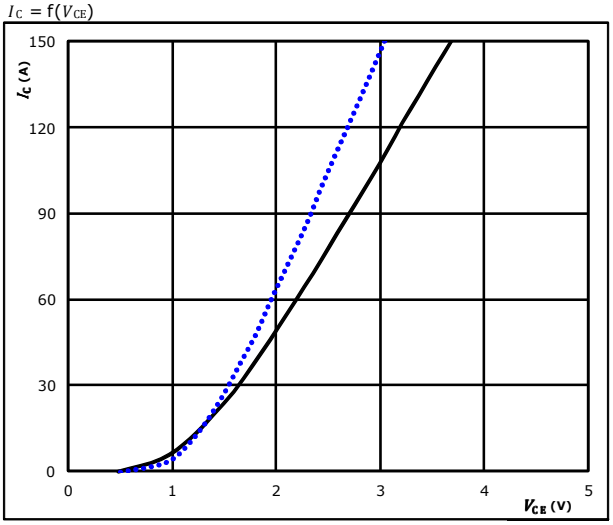
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Rectifier Diode										
Static										
Forward voltage	V_F				35	25 125	0,8	1,17 1,13	1,6	V
Reverse leakage current	I_r			1600		25 145			50 1100	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,25		K/W
DC Link Capacitance										
Capacitance	C							150		nF
Tolerance							-10		+10	%
Dissipation factor		f= 1 kHz				25			2,5	%
Climatic category							55/125/56			
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1486 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	

Boost Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

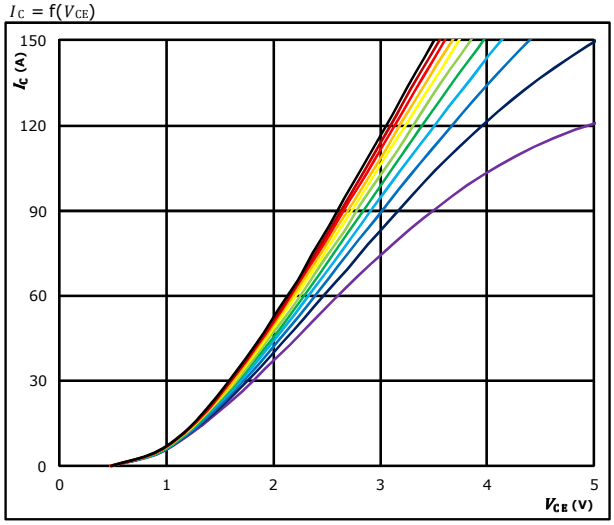


t_p =	250	µs		25 °C	
V_{GE} =	15	V	T_j:	125 °C	

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

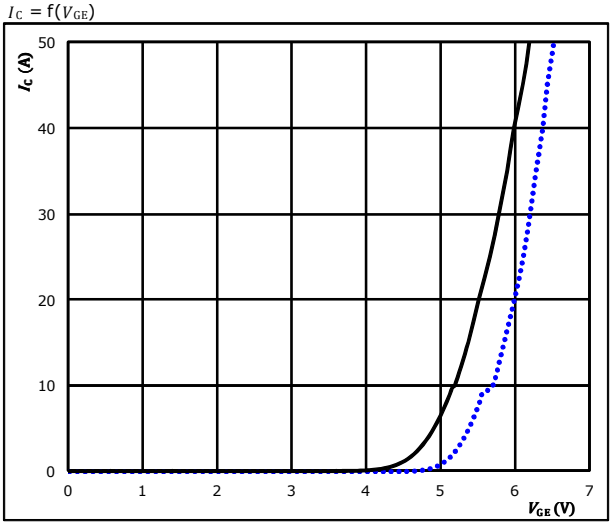


t_p =	250	µs
T_j =	125	°C
V_{GE} from	8 V to 18 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

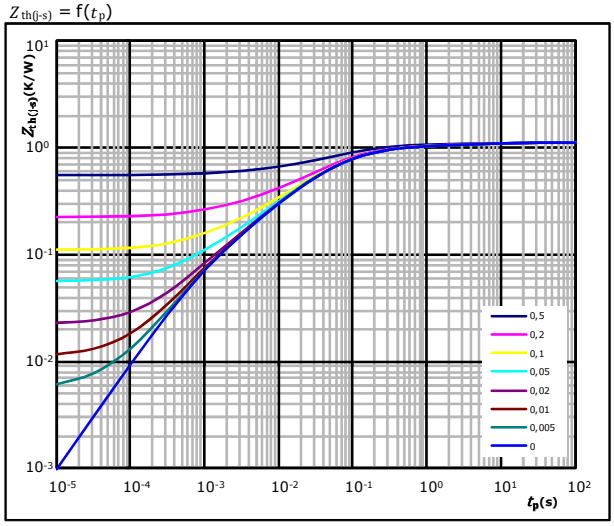


t_p =	100	µs		25 °C	
V_{CE} =	10	V	T_j:	125 °C	

figure 4. **IGBT**

Transient Thermal Impedance as function of Pulse duration

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,13	K/W

IGBT thermal model values

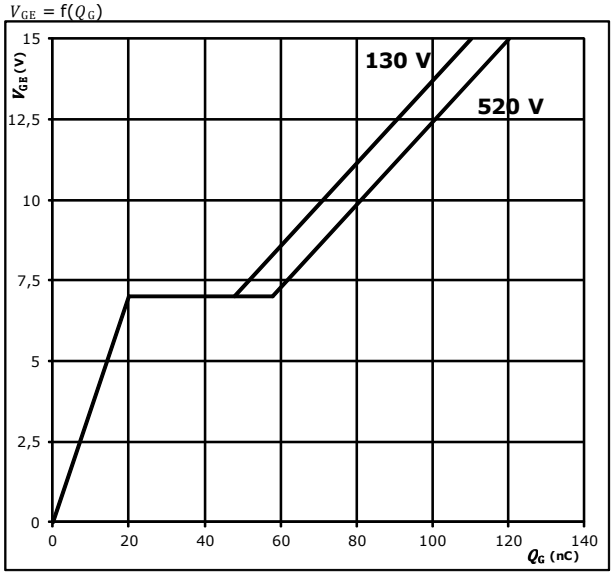
R (K/W)	τ (s)
7,12E-02	8,15E+00
1,29E-01	6,00E-01
4,31E-01	9,13E-02
3,15E-01	2,59E-02
1,31E-01	5,80E-03
5,02E-02	8,53E-04

Boost Switch Characteristics

figure 5. **IGBT**

Gate voltage vs Gate charge

$V_{GE} = f(Q_G)$



At

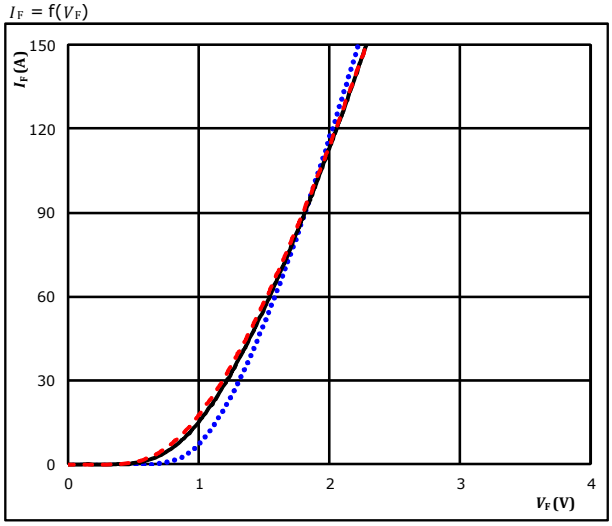
I_C= 50 A

Boost Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



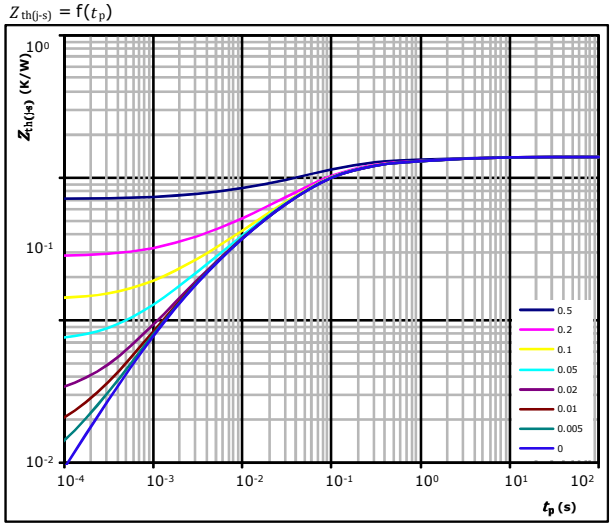
t_p = 250 µs

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

$R_{th(j-s)}$ = 1,41 K/W

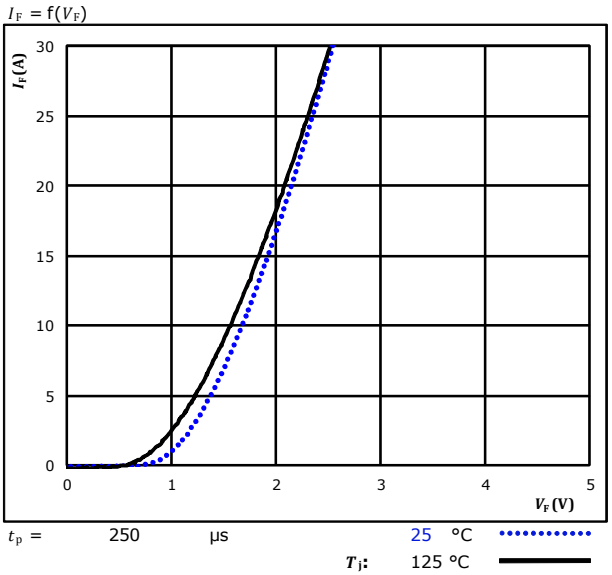
FWD thermal model values

R (K/W)	τ (s)
8,12E-02	4,01E+00
1,48E-01	6,15E-01
5,58E-01	9,08E-02
3,75E-01	2,92E-02
1,82E-01	6,56E-03
6,20E-02	1,34E-03

Boost Sw. Protection Diode Characteristics

figure 1. **FWD**

Typical forward characteristics



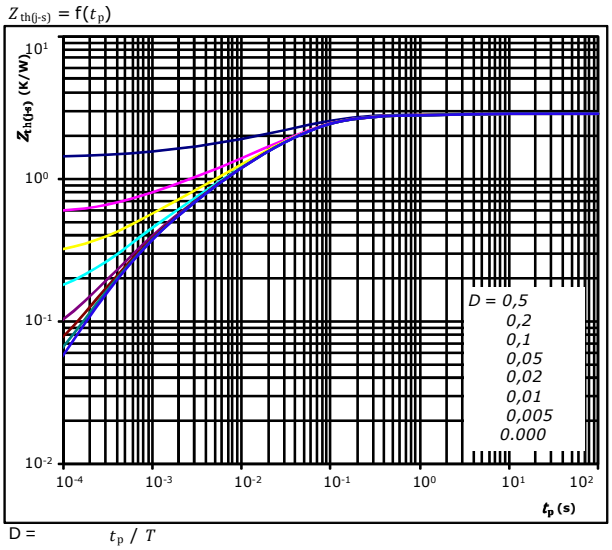
t_p = 250 µs

25 °C

T_j: 125 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width



D = t_p / T

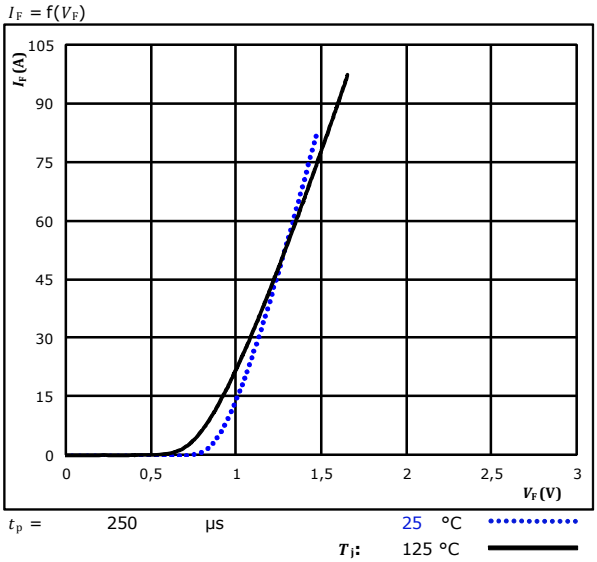
$R_{th(j-s)}$ = 2,87 K/W

FWD thermal model values

R (K/W)	τ (s)
6,5290E-02	3,9390E+00
1,4760E-01	4,4830E-01
1,3130E+00	5,9640E-02
7,3180E-01	1,3610E-02
4,0440E-01	2,7940E-03
2,1060E-01	5,3720E-04

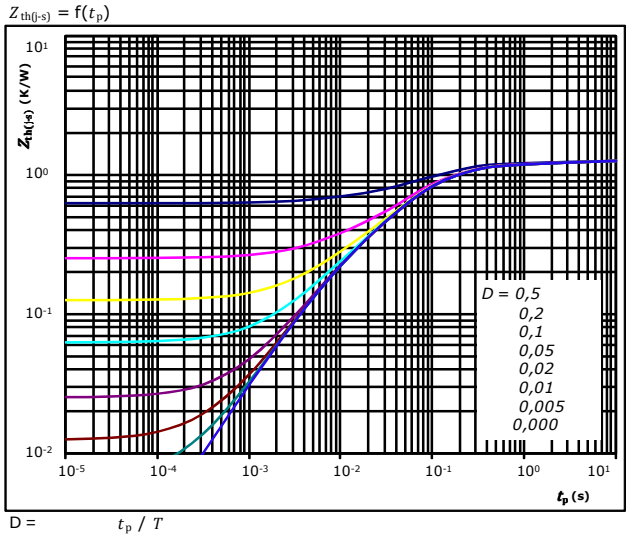
Rectifier Diode Characteristics

figure 1. **Rectifier Diode**
Typical forward characteristics



t_p = 250 µs
T_j: 25 °C
125 °C

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



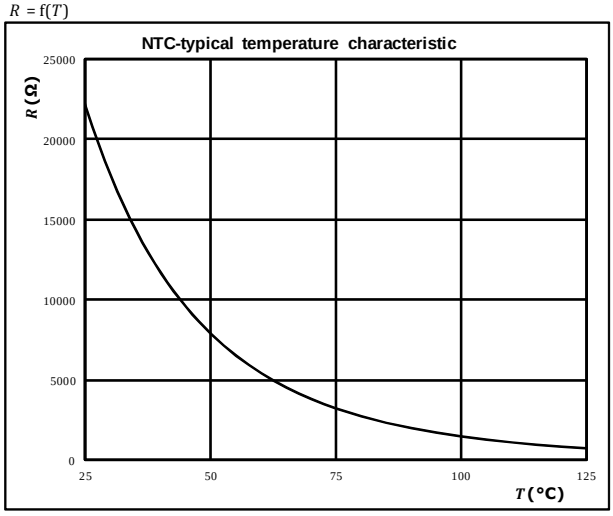
D = t_p / T
$R_{th(j-s)}$ = 1,25 K/W

Diode thermal model values

R (K/W)	τ (s)
8,0030E-02	5,2210E+00
1,5580E-01	4,1790E-01
6,9510E-01	8,8210E-02
2,2330E-01	3,0740E-02
9,9710E-02	5,9900E-03

Thermistor Characteristics

figure 1. **Thermistor**
Thermistor typical temperature characteristic

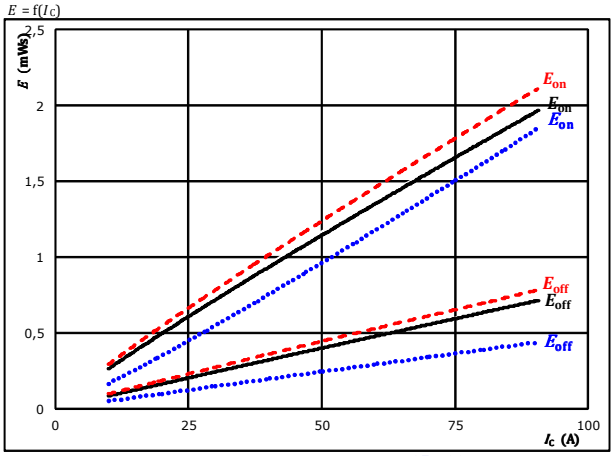


Boost Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



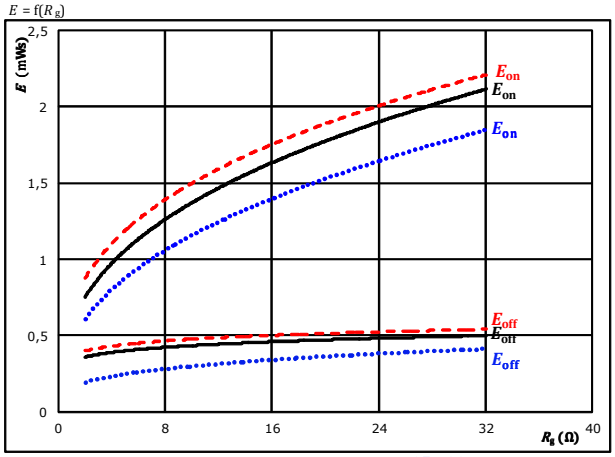
With an inductive load at

V_{CE} =	350	V	T_J:	25 °C	
V_{GE} =	-5 / 15	V		125 °C	
R_{gon} =	8	Ω		150 °C	
R_{goff} =	8	Ω			

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



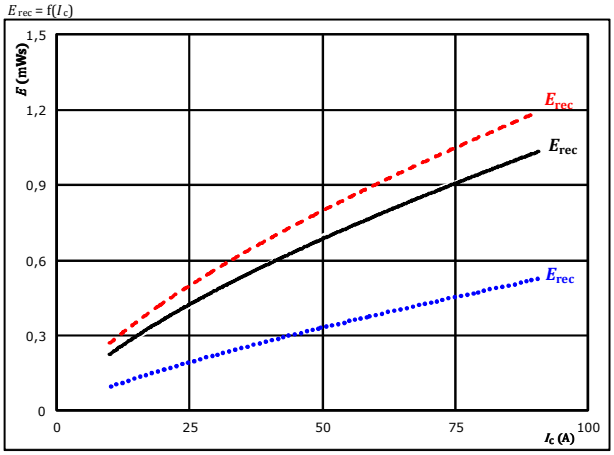
With an inductive load at

V_{CE} =	350	V	T_J:	25 °C	
V_{GE} =	-5 / 15	V		125 °C	
I_C =	50	A		150 °C	

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



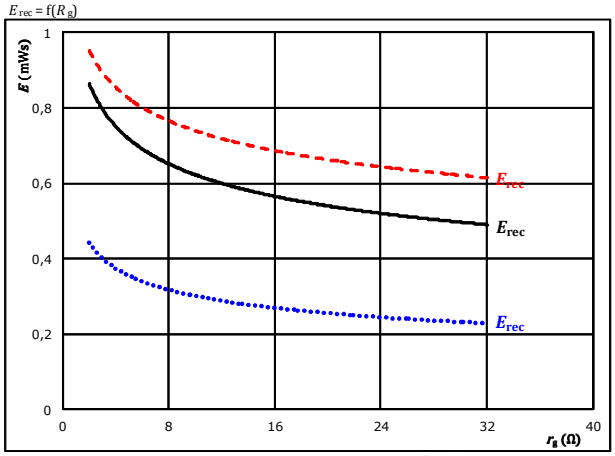
With an inductive load at

V_{CE} =	350	V	T_J:	25 °C	
V_{GE} =	-5 / 15	V		125 °C	
R_{gon} =	8	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

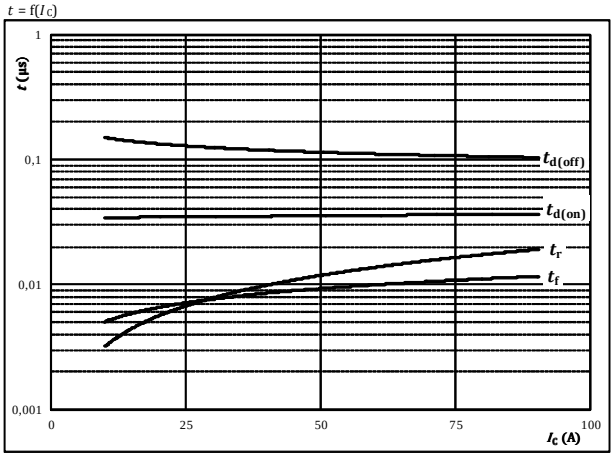
V_{CE} =	350	V	T_J:	25 °C	
V_{GE} =	-5 / 15	V		125 °C	
I_C =	50	A		150 °C	

Boost Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



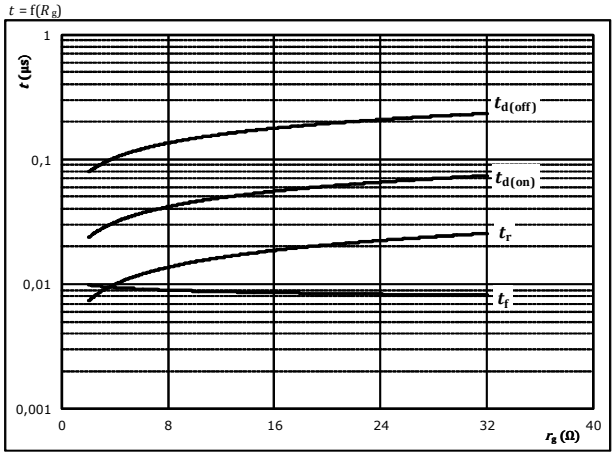
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	-5 / 15	V
R_{gon} =	8	Ω
R_{goff} =	8	Ω

figure 6. IGBT

Typical switching times as a function of gate resistor

$t = f(R_g)$



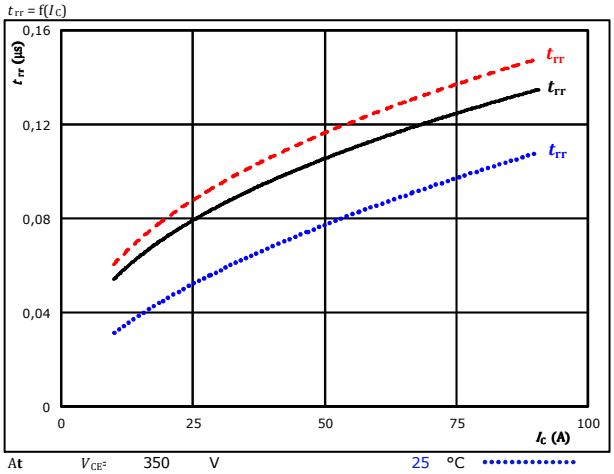
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	-5 / 15	V
I_C =	50	A

figure 7. FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



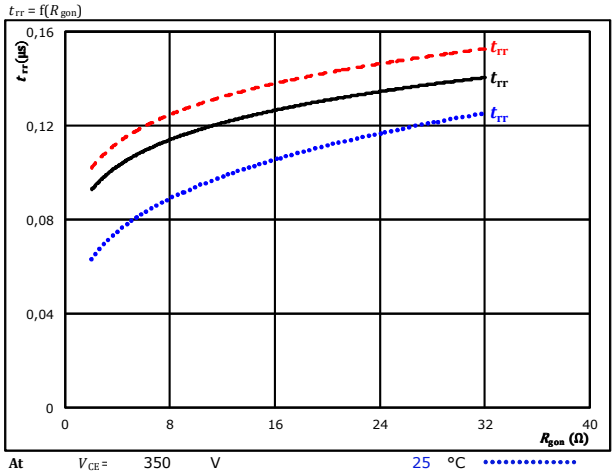
At

V_{CE} =	350	V	T_j:	25 °C	·····
V_{GE} =	-5 / 15	V		125 °C	———
R_{gon} =	8	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

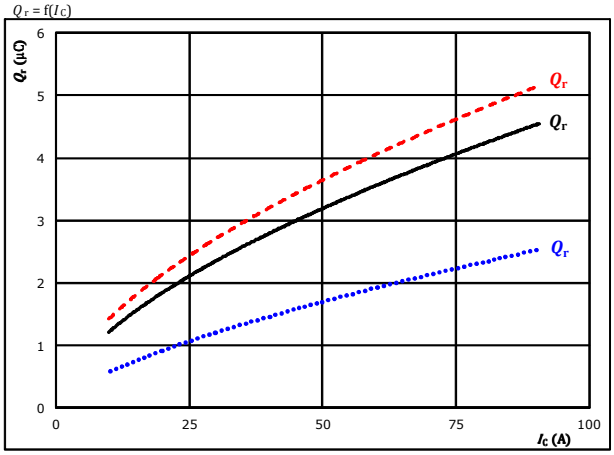
V_{CE} =	350	V	T_j:	25 °C	·····
V_{GE} =	-5 / 15	V		125 °C	———
I_C =	50	A		150 °C	– – –

Boost Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

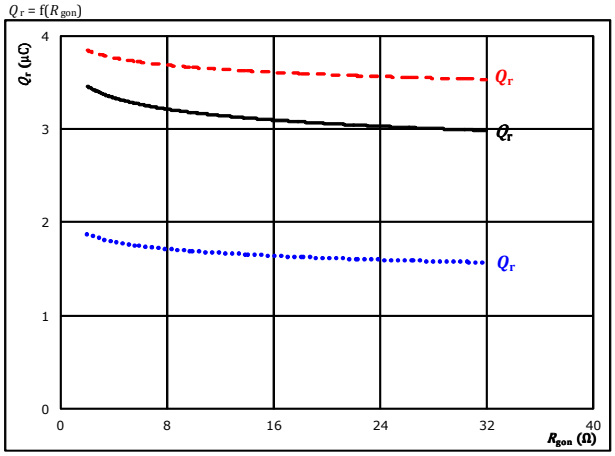


At						
	V_{CE} =	350	V		25 °C	
	V_{GE} =	-5 / 15	V	T_j:	125 °C	
	R_{gon} =	8	Ω		150 °C	

figure 10. FWD

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

$Q_r = f(R_{gon})$

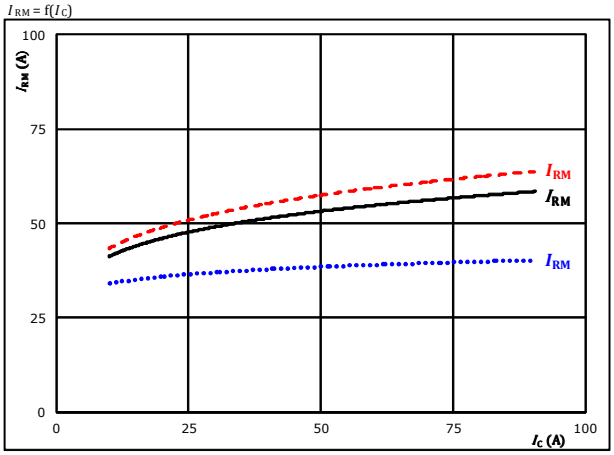


At						
	V_{CE}=	350	V		25 °C	
	V_{GE} =	-5 / 15	V	T_j:	125 °C	
	I_C=	50	A		150 °C	

figure 11. FWD

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

$I_{RM} = f(I_C)$

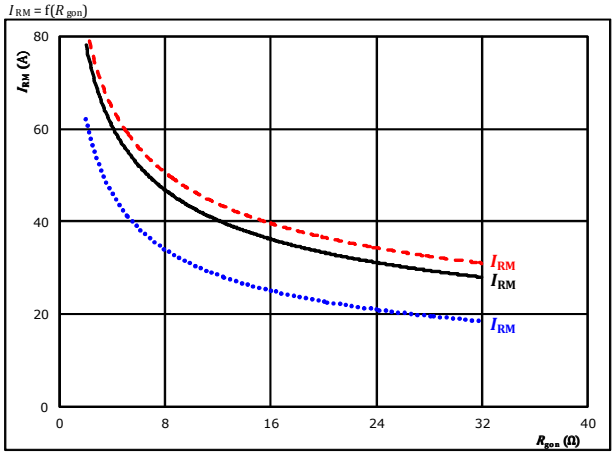


At						
	V_{CE}:	350	V		25 °C	
	V_{GE} =	-5 / 15	V	T_j:	125 °C	
	R_{gon} =	8	Ω		150 °C	

figure 12. FWD

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

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



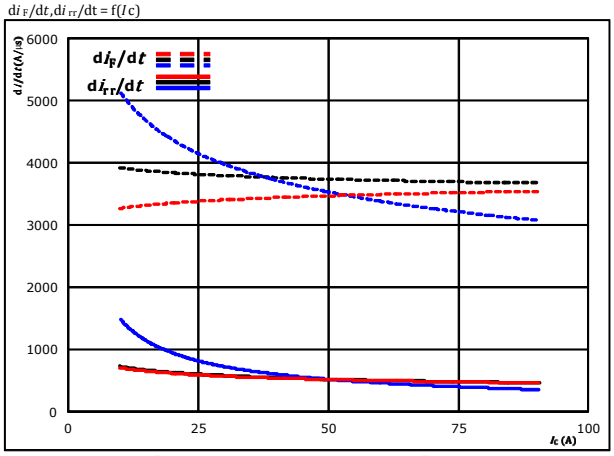
At						
	V_{CE} =	350	V		25 °C	
	V_{GE} =	-5 / 15	V	T_j:	125 °C	
	I_C =	50	A		150 °C	

Boost Switching Characteristics

figure 13. **FWD**

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

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

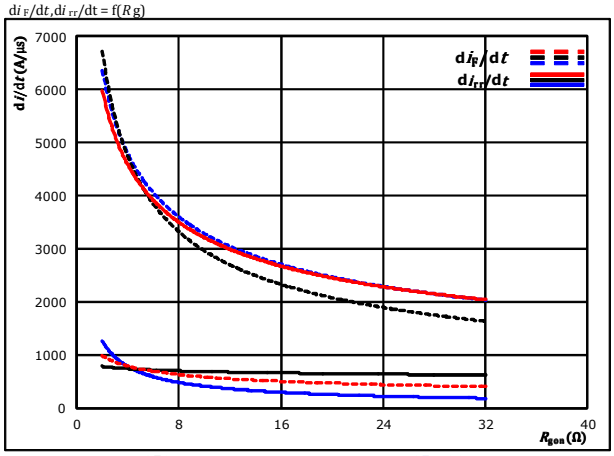


At	V_{CE}:	350	V	T_j:	25 °C	
	V_{GE} =	-5 / 15	V		125 °C	
	R_{gon} =	8	Ω		150 °C	

figure 14. **FWD**

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

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

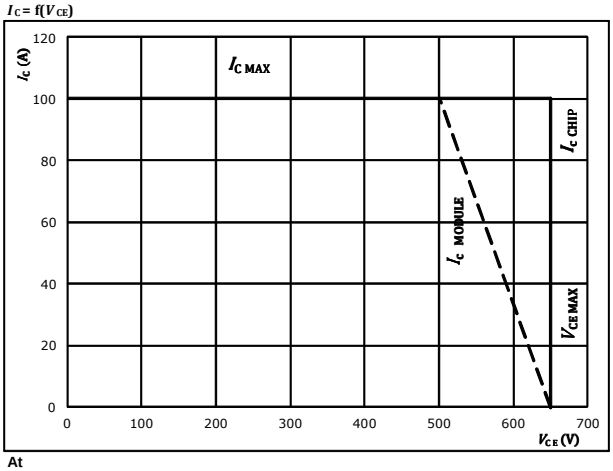


At	V_{CE} =	350	V	T_j:	25 °C	
	V_{GE} =	-5 / 15	V		125 °C	
	I_C=	50	A		150 °C	

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	175	°C	
R_{gon} =	8	Ω	
R_{goff} =	8	Ω	

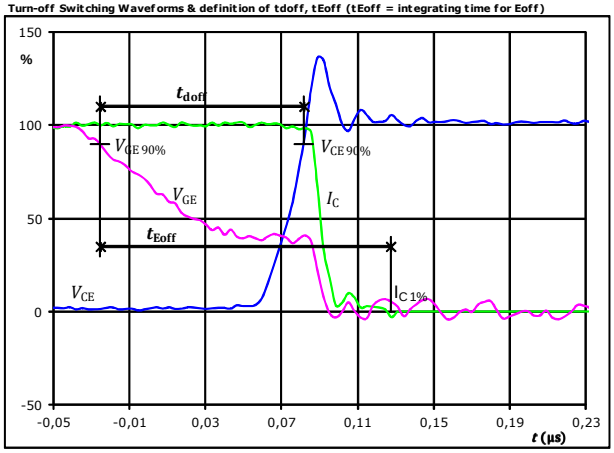
Boost Switching Characteristics

General conditions

T_j	=	125 °C
R_{gon}	=	8 Ω
R_{goff}	=	8 Ω

figure 1. IGBT

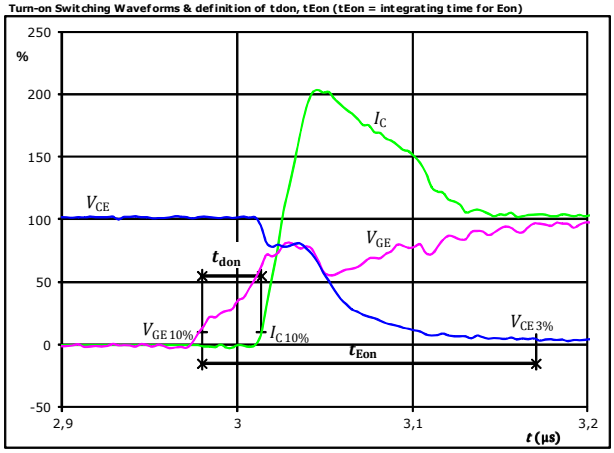
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	-5	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	50	A
t_{doff} =	0,109	µs
t_{Eoff} =	0,152	µs

figure 2. IGBT

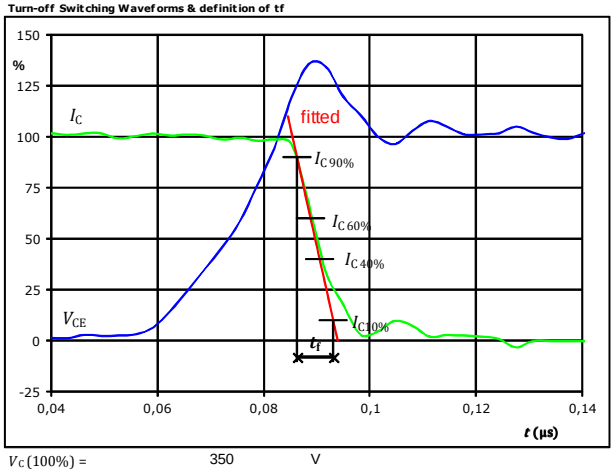
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	-5	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	50	A
t_{don} =	0,036	µs
t_{Eon} =	0,191	µs

figure 3. IGBT

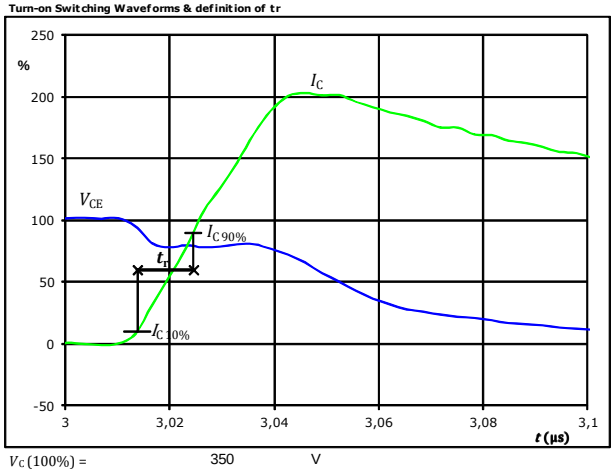
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	50	A
t_f =	0,007	µs

figure 4. IGBT

Turn-on Switching Waveforms & definition of tr

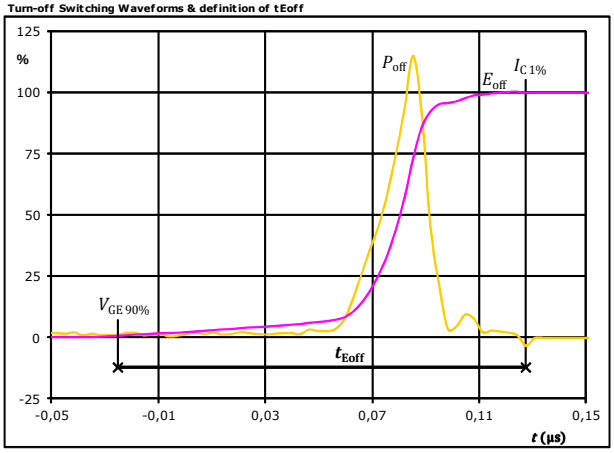


$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	50	A
t_r =	0,011	µs

Boost Switching Characteristics

figure 5. **IGBT**

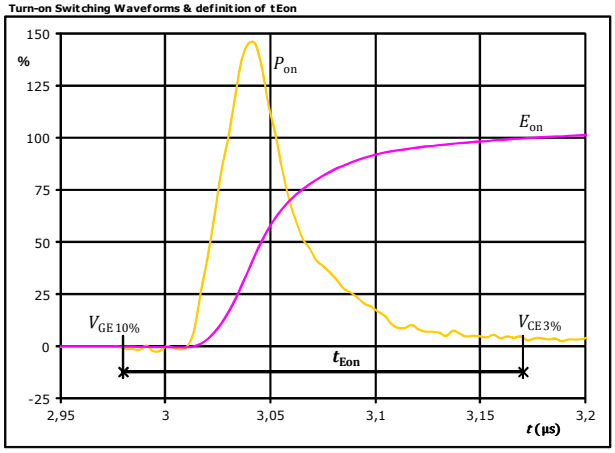
Turn-off Switching Waveforms & definition of tEoff



$P_{off}(100\%) =$	17,40	kW
$E_{off}(100\%) =$	0,39	mJ
$t_{Eoff} =$	0,15	µs

figure 6. **IGBT**

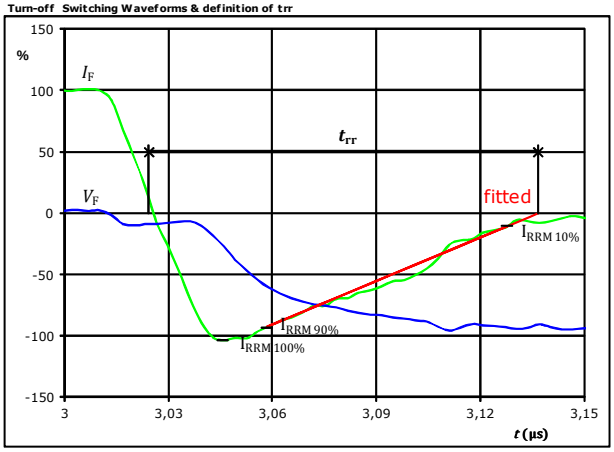
Turn-on Switching Waveforms & definition of tEon



$P_{on}(100\%) =$	17,40	kW
$E_{on}(100\%) =$	1,16	mJ
$t_{Eon} =$	0,19	µs

figure 7. **FWD**

Turn-off Switching Waveforms & definition of trr

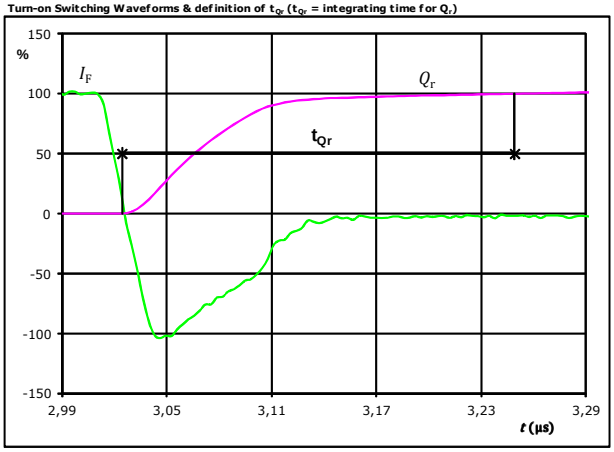


$V_F(100\%) =$	350	V
$I_F(100\%) =$	50	A
$I_{RRM}(100\%) =$	-52	A
$t_{rr} =$	0,109	µs

Boost Switching Characteristics

figure 8. **FWD**

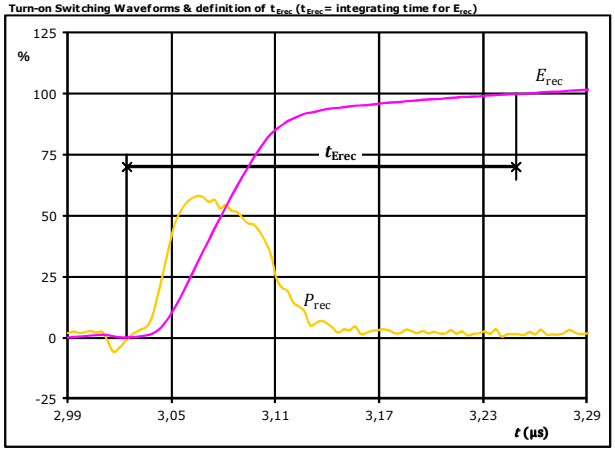
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	50	A
Q_r (100%) =	3,29	µC
t_{Qr} =	0,22	µs

figure 9. **FWD**

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



P_{rec} (100%) =	17,40	kW
E_{rec} (100%) =	0,70	mJ
t_{Erec} =	0,22	µs

Vincotech

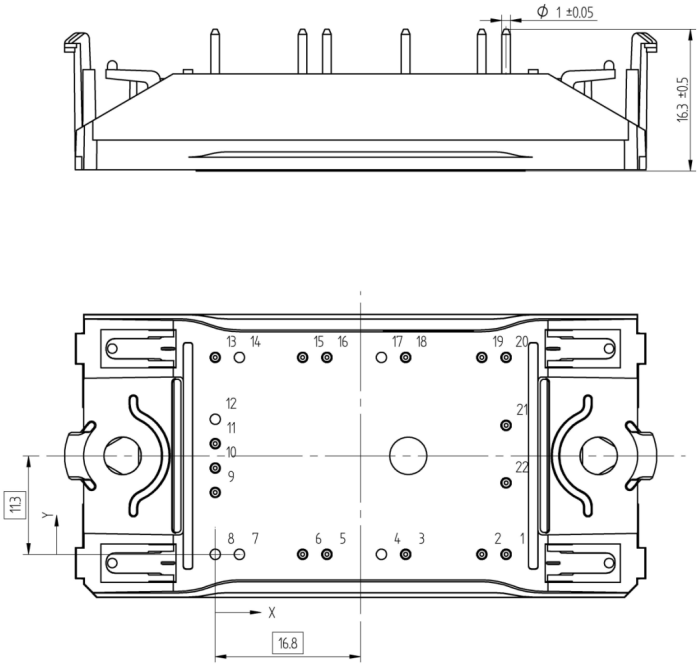
Ordering Code & Marking

Version	Ordering Code
without thermal paste 12mm housing with solder pins	10-FZ071SA050SM02-L524L18
with thermal paste 12mm housing with solder pins	10-FZ071SA050SM02-L524L18-/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		

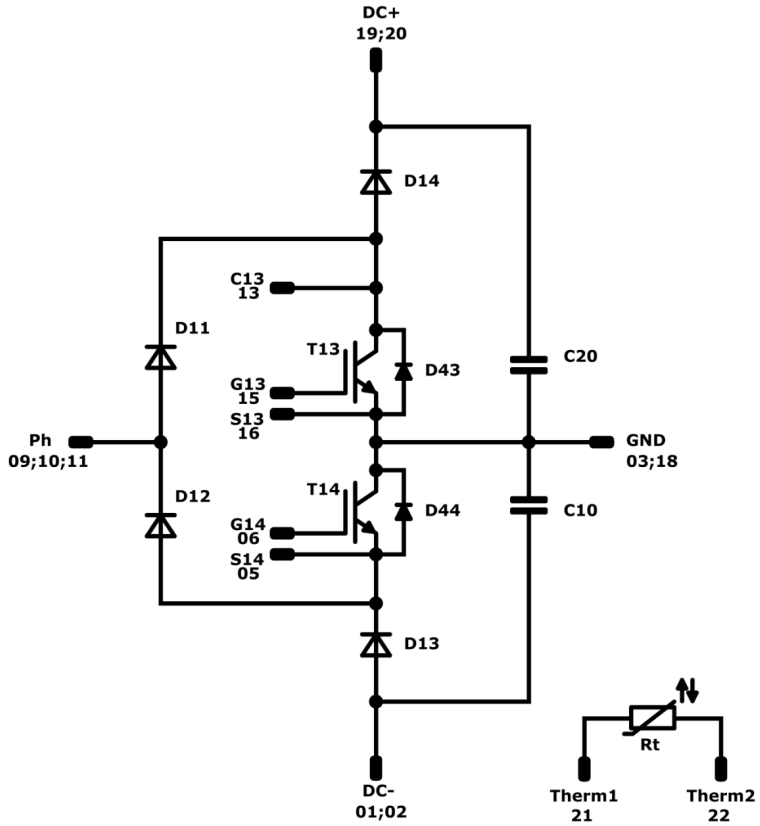
Outline

Pin table [mm]			
Pin	X	Y	Function
1	33,6	0	DC-
2	30,8	0	DC-
3	22	0	GND
4	not assembled		
5	12,9	0	S14
6	10,1	0	G14
7	not assembled		
8	not assembled		
9	0	7,1	Ph
10	0	9,9	Ph
11	0	12,7	Ph
12	not assembled		
13	0	22,6	C13
14	not assembled		
15	10,1	22,6	G13
16	12,9	22,6	S13
17	not assembled		
18	22	22,6	GND
19	30,8	22,6	DC+
20	33,6	22,6	DC+
21	33,6	14,8	Therm1
22	33,6	8,2	Therm2



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
T13, T14	IGBT	650 V	50 A	Boost Switch	
D13, D14	FWD	650 V	50 A	Boost Diode	
D43, D44	FWD	650 V	10 A	Boost Sw. Protection Diode	
D11, D12	FWD	1600 V	35 A	Rectifier Diode	
C10, C20	Capacitor	630 V		DC Link Capacitance	
Rt	Thermistor			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 135	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 0 packages see vincotech.com website.

Package data
Package data for *flow* 0 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-FZ071SA050SM02-L524L18-D1-14	12 Jul. 2016		