10-FY076PA050S501-L822F58

datasheet

_flow_PACK 1 | **650 V / 50 A**

Topology features

- Inverter
- Kelvin Emitter for improved switching performance
- Temperature sensor

Component features

- High speed and smooth switching
- Low gate charge
- Very low collector emitter saturation voltage

Housing features

- Base isolation: Al_2O_3
- Convex shaped substrate for superior thermal contact
- Thermo-mechanical push-and-pull force relief
- Solder pin

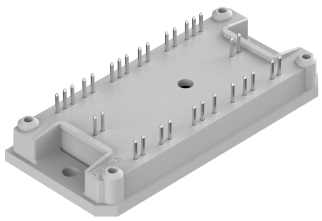
Target applications

- Energy Storage Systems
- Solar Inverters

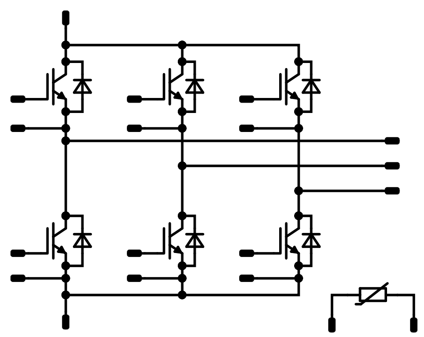
Types

- 10-FY076PA050S501-L822F58

flow 1 12 mm housing



Schematic



Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Inverter Switch					
Collector-emitter voltage	V_{CES}			650	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	48	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	73	W
Gate-emitter voltage	V_{GES}			±20	V
Maximum junction temperature	T_{jmax}			175	°C
Inverter Diode					
Peak repetitive reverse voltage	V_{RRM}			650	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	46	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		100	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	68	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
Isolation voltage	V_{isol}	AC Voltage	t_p = 1 min	2500	V
Creepage distance				>12,7	mm
Clearance				7,81	mm
Comparative Tracking Index	CTI			≥ 600	

*100 % tested in production

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]	Values Min	Values Typ	Values Max	Unit
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0005	25	3,2	4	4,8	V
Collector-emitter saturation voltage	V_{CEsat}		15		50	25 125 150		1,39 1,48 1,51	1,75(1)	V
Collector-emitter cut-off current	I_{CES}		0	650		25			50	µA
Gate-emitter leakage current	I_{GES}		20	0		25			100	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}							3100		pF
Output capacitance	C_{oes}	f = 1 Mhz	0	25		25		88		pF
Reverse transfer capacitance	C_{res}							12		pF
Gate charge	Q_g	V_{CC} = 520 V	15		50	25		120		nC
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,29		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$					25 125 150		23,72 24,17 24,12		ns
Rise time	t_r	R_{gon} = 4 Ω R_{goff} = 4 Ω				25 125 150		7,36 8,64 9,14		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		72,46 88,73 92,68		ns
Fall time	t_f		-5/15	350	50	25 125 150		17,74 38,16 42,72		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=1,51 µC Q_{rFWD}=3,1 µC Q_{rFWD}=3,57 µC				25 125 150		0,266 0,406 0,453		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,554 0,849 0,953		mWs

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
Inverter Diode										
Static										
Forward voltage	V_F				50	25 125	1,18	1,63 1,53	1,82(1)	V
Reverse leakage current	I_R	V_r = 650 V				25			0,6	µA
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,4		K/W
Dynamic										
Peak recovery current	I_{RM}	di/dt=6202 A/µs di/dt=5871 A/µs di/dt=5800 A/µs	-5/15	350	50	25 125 150		61,68 81,42 86,91		A
Reverse recovery time	t_{rr}					25 125 150		90,35 131,42 140,97		ns
Recovered charge	Q_r					25 125 150		1,51 3,1 3,57		µC
Reverse recovered energy	E_{rec}					25 125 150		0,435 0,897 1,03		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		4295,76 3618,97 3552,81		A/µs

10-FY076PA050S501-L822F58
datasheet

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Characteristic Values

Parameter	Symbol	Conditions					Values			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	
Thermistor										
Static										
Rated resistance	R					25		22		kΩ
Deviation of R100	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P					25		130		mW
Power dissipation constant	d					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %						3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %						4000		K
Vincotech Thermistor Reference									I	

(1) Value at chip level

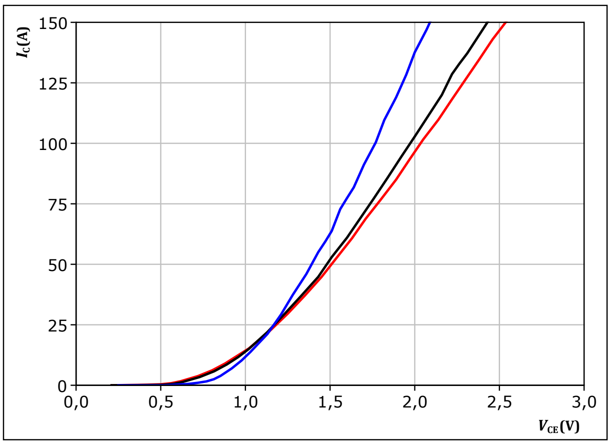
(2) Only valid with pre-applied Vincotech thermal interface material.

Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

I_C = f(V_{CE})



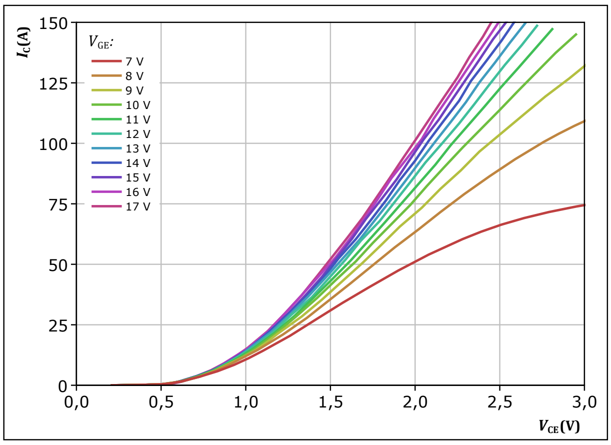
t_p =	250	µs
V_{GE} =	15	V

T_j: 25 °C, 125 °C, 150 °C

figure 2. IGBT

Typical output characteristics

I_C = f(V_{CE})



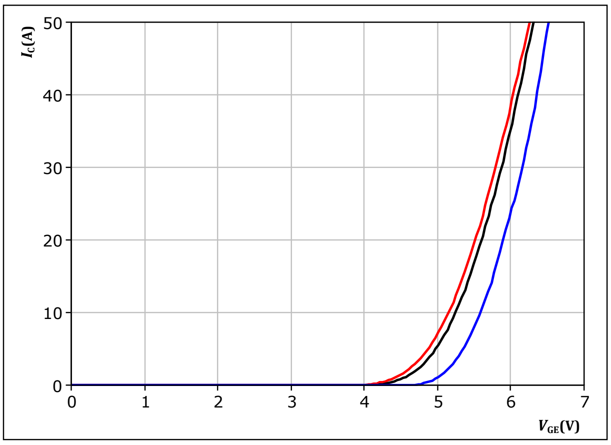
t_p =	250	µs
T_j =	150	°C

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

figure 3. IGBT

Typical transfer characteristics

I_C = f(V_{GE})



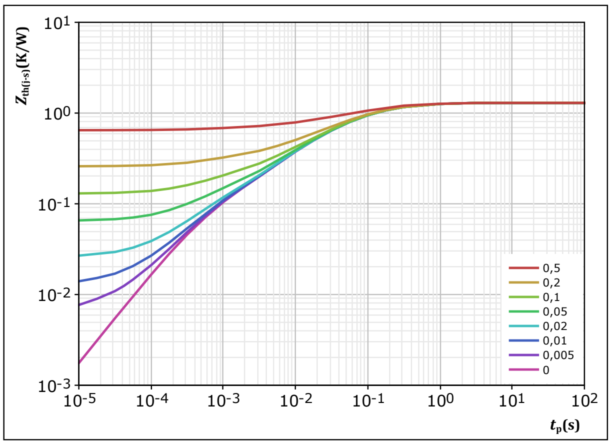
t_p =	250	µs
V_{CE} =	10	V

T_j: 25 °C, 125 °C, 150 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,294	K/W

IGBT thermal model values

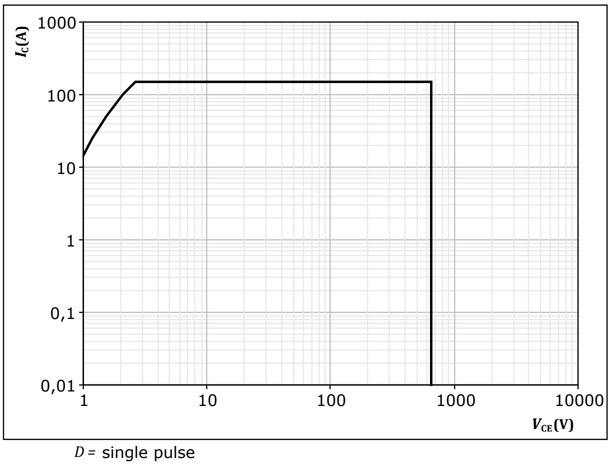
R (K/W)	τ (s)
2,09E-01	5,36E-01
6,00E-01	8,05E-02
3,10E-01	1,69E-02
1,08E-01	4,25E-03
6,63E-02	5,30E-04

Inverter Switch Characteristics

figure 5.	IGBT

Safe operating area

I_C = f(V_{CE})

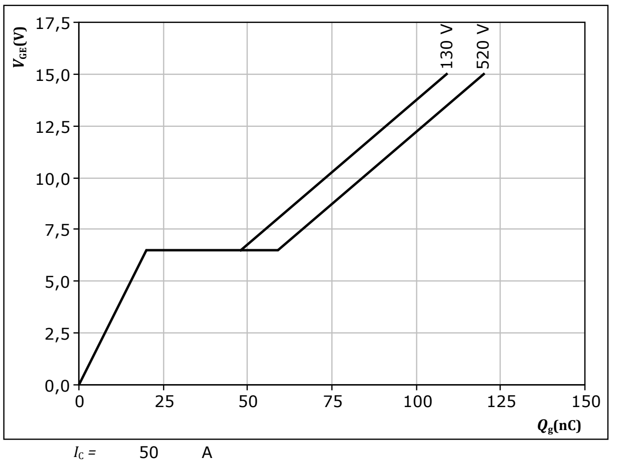


D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

figure 6.	IGBT

Gate voltage vs gate charge

V_{GE} = f(Q_g)



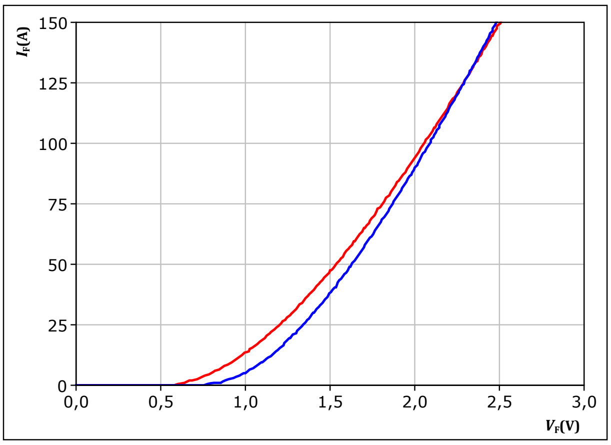
I_C =	50	A
T_j =	25	°C

Inverter Diode Characteristics

figure 7. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



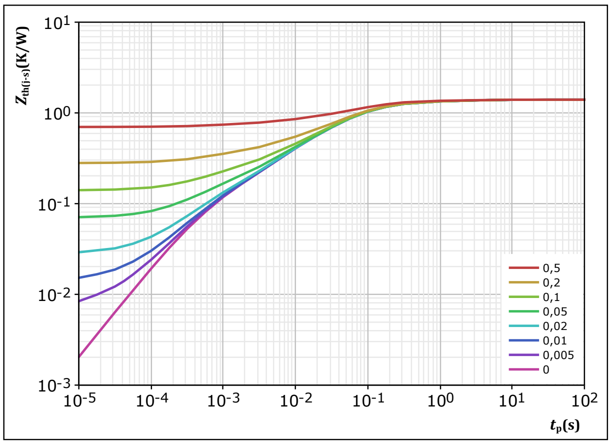
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 8. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,399 K/W

FWD thermal model values

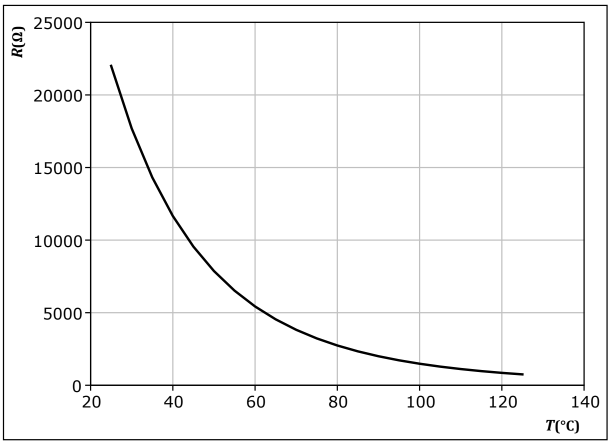
R (K/W)	τ (s)
6,76E-02	3,05E+00
1,79E-01	3,50E-01
6,70E-01	7,08E-02
2,72E-01	1,81E-02
1,35E-01	4,13E-03
7,56E-02	5,11E-04

Thermistor Characteristics

figure 9.	Thermistor

Typical NTC characteristic as function of temperature

R_T = f(T)

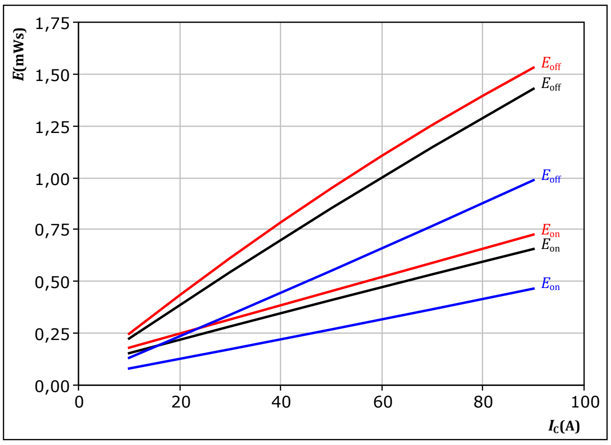


Inverter Switching Characteristics

figure 10. **IGBT**

Typical switching energy losses as a function of collector current

E = f(I_C)



With an inductive load at

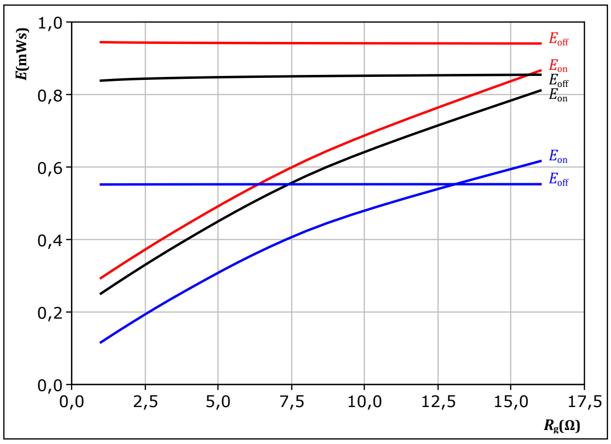
V_{CE} =	350	V	
V_{GE} =	-5/15	V	
R_{gon} =	4	Ω	
R_{goff} =	4	Ω	

T_j: 25 °C / 125 °C / 150 °C

figure 11. **IGBT**

Typical switching energy losses as a function of IGBT turn on gate resistor

E = f(R_g)



With an inductive load at

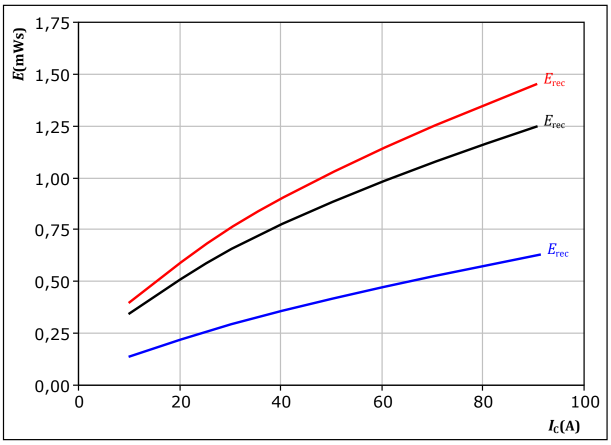
V_{CE} =	350	V
V_{GE} =	-5/15	V
I_C =	50	A

T_j: 25 °C / 125 °C / 150 °C

figure 12. **FWD**

Typical reverse recovered energy loss as a function of collector current

E_{rec} = f(I_C)



With an inductive load at

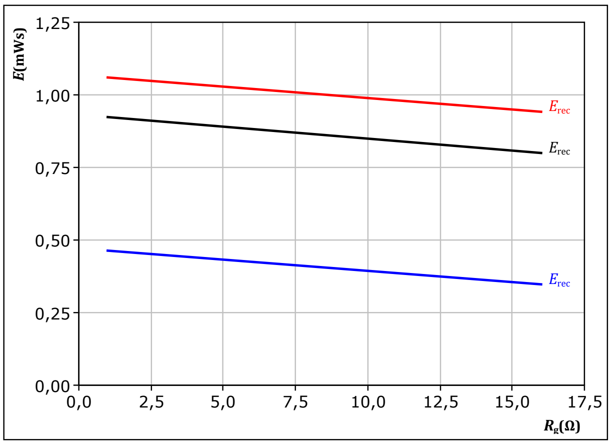
V_{CE} =	350	V
V_{GE} =	-5/15	V
R_{gon} =	4	Ω

T_j: 25 °C / 125 °C / 150 °C

figure 13. **FWD**

Typical reverse recovered energy loss as a function of IGBT turn on gate resistor

E_{rec} = f(R_g)



With an inductive load at

V_{CE} =	350	V
V_{GE} =	-5/15	V
I_C =	50	A

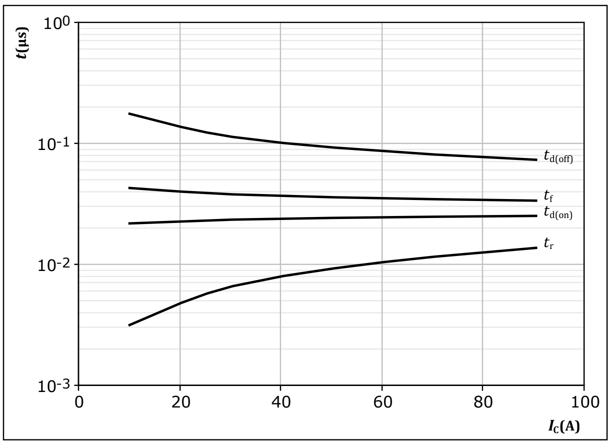
T_j: 25 °C / 125 °C / 150 °C

Inverter Switching Characteristics

figure 14. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



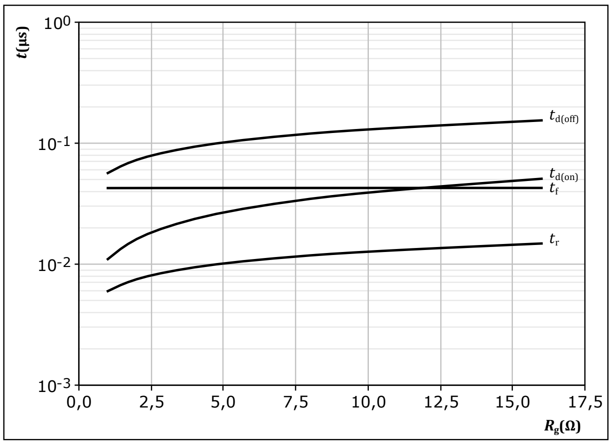
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	-5/15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 15. **IGBT**

Typical switching times as a function of IGBT turn on gate resistor

t = f(R_g)



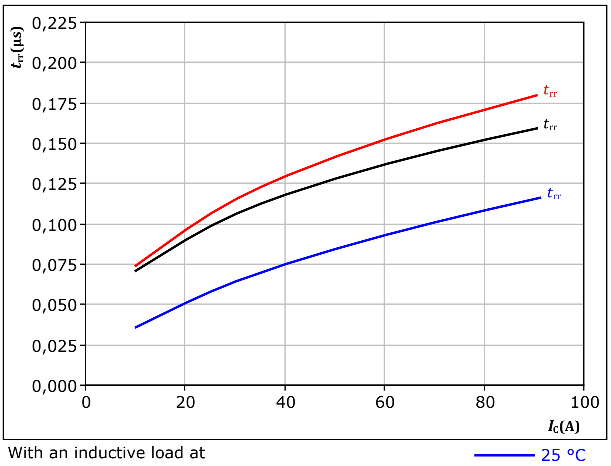
With an inductive load at

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

figure 16. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

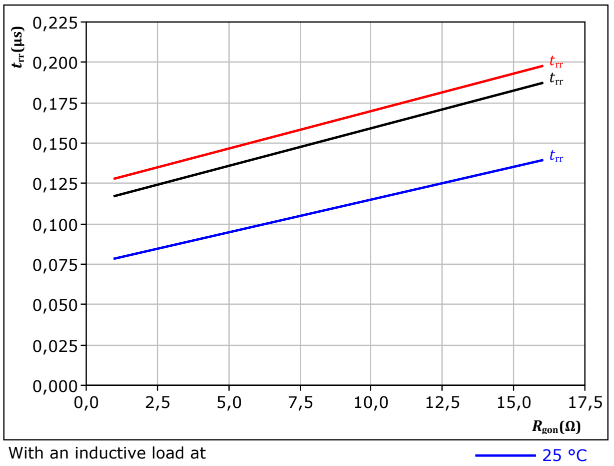
V_{CE} =	350	V
V_{GE} =	-5/15	V
R_{gon} =	4	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 17. **FWD**

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

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



With an inductive load at

V_{CE} =	350	V
V_{GE} =	-5/15	V
I_C =	50	A

T_j: 25 °C, 125 °C, 150 °C

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10-FY076PA050S501-L822F58
datasheet

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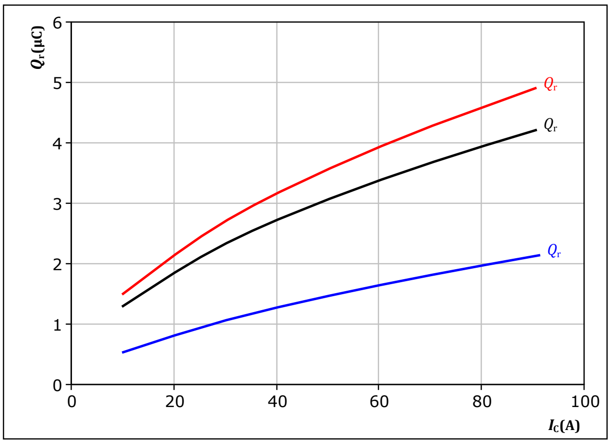
Inverter Switching Characteristics

figure 18. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



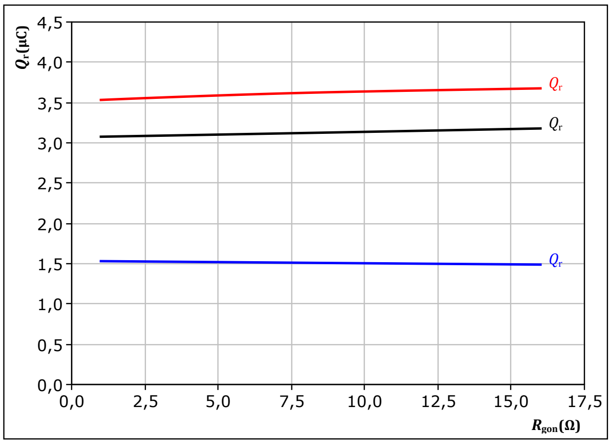
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	-5/15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 19. **FWD**

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

Q_r = f(R_{gon})



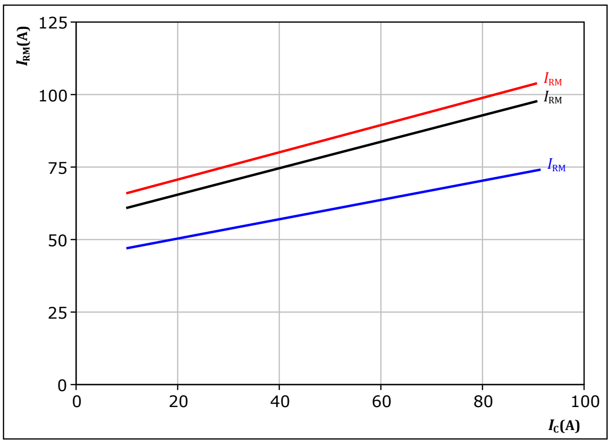
With an inductive load at

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

figure 20. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



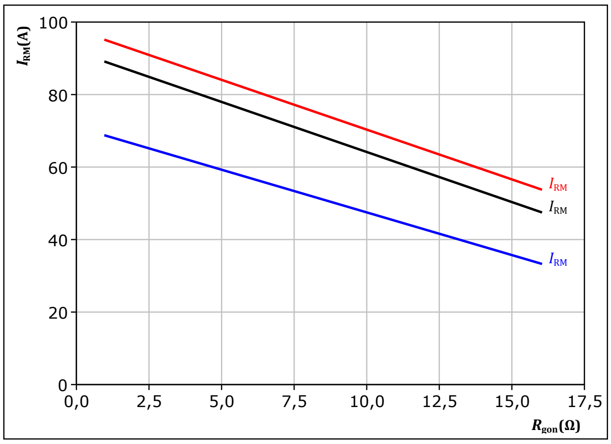
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	-5/15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 21. **FWD**

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

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



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

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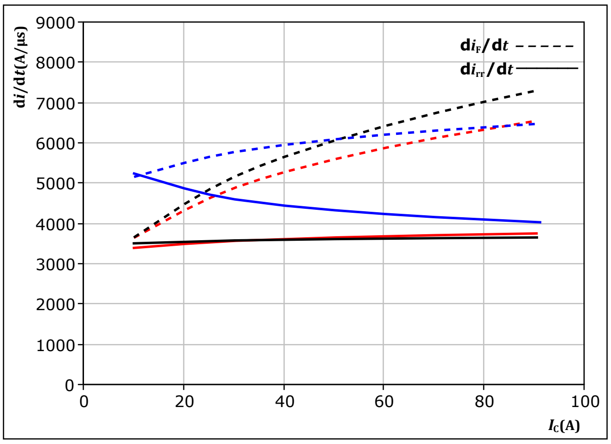
Inverter Switching Characteristics

figure 22. **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)



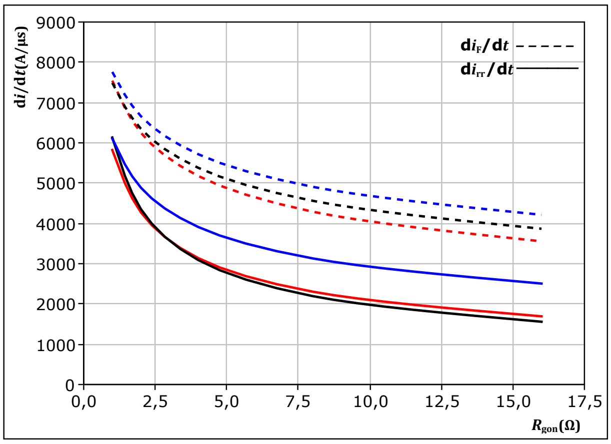
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	-5/15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 23. **FWD**

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

di_F/dt, di_{rr}/dt = f(R_{gon})



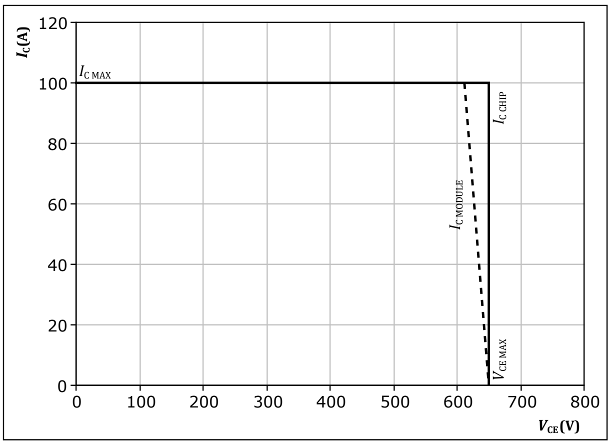
With an inductive load at

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

figure 24. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At	T_j =	150	°C
	R_{gon} =	4	Ω
	R_{goff} =	4	Ω

Inverter Switching Definitions

figure 25. **IGBT**

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

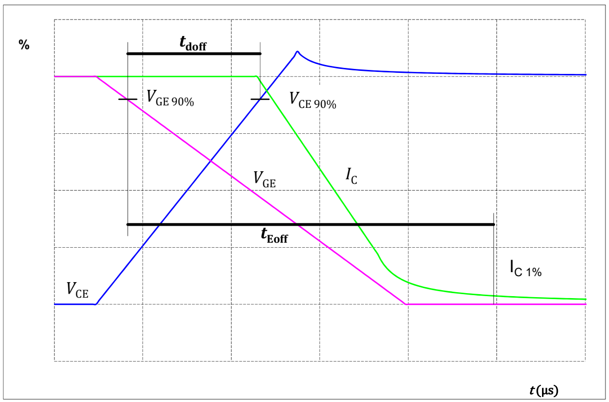


figure 26. **IGBT**

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

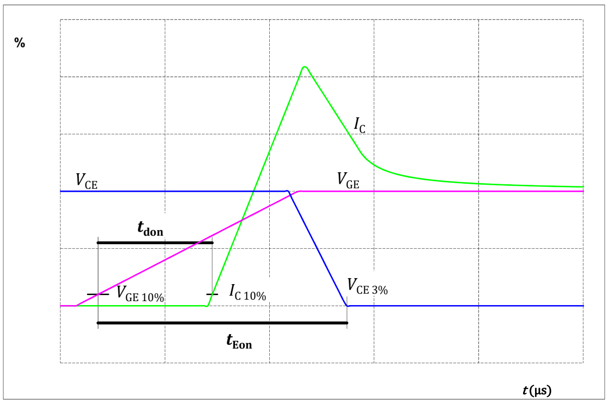


figure 27. **IGBT**

Turn-off Switching Waveforms & definition of t_f

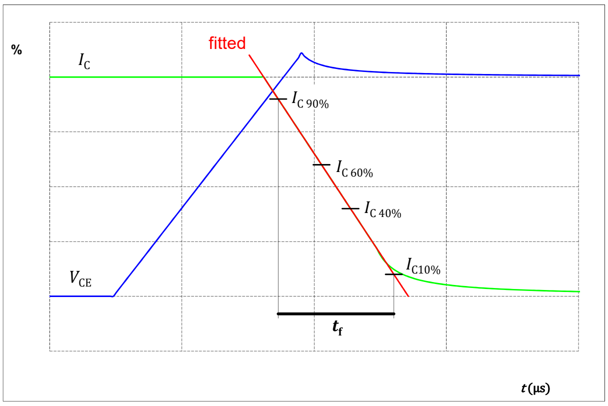
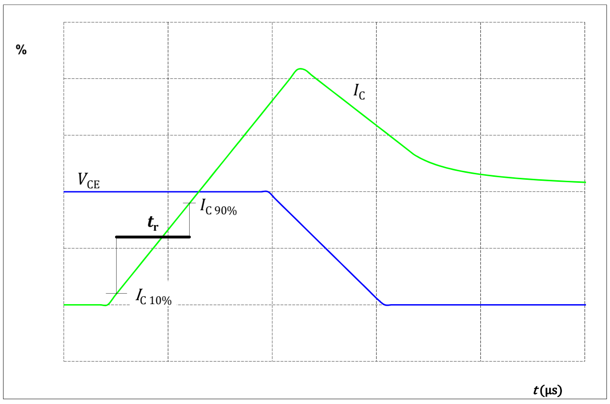


figure 28. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Inverter Switching Definitions

figure 29. **FWD**

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

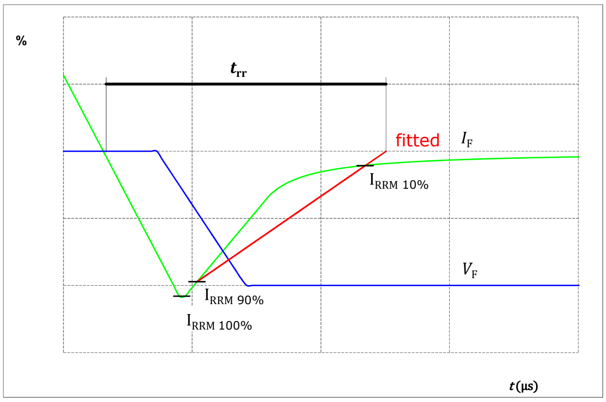
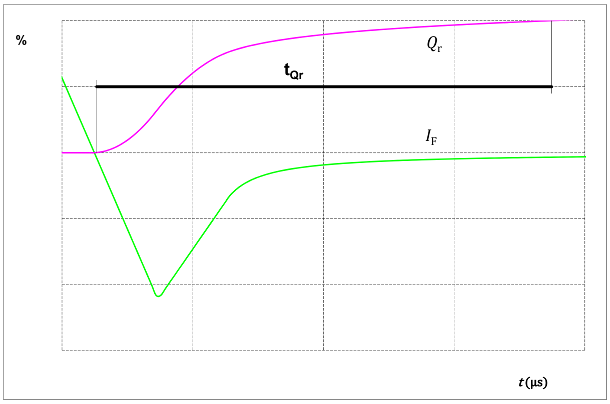


figure 30. **FWD**

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



Ordering Code

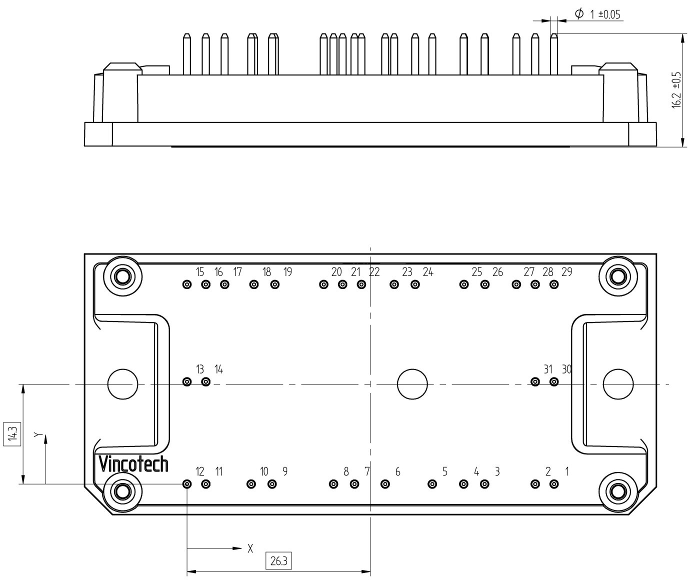
Version	Ordering Code
Without thermal paste	10-FY076PA050S501-L822F58
With thermal paste (5,2 W/mK, PTM6000HV)	10-FY076PA050S501-L822F58-/7/
With thermal paste (3,4 W/mK, PSX-P7)	10-FY076PA050S501-L822F58-/3/

Marking

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		

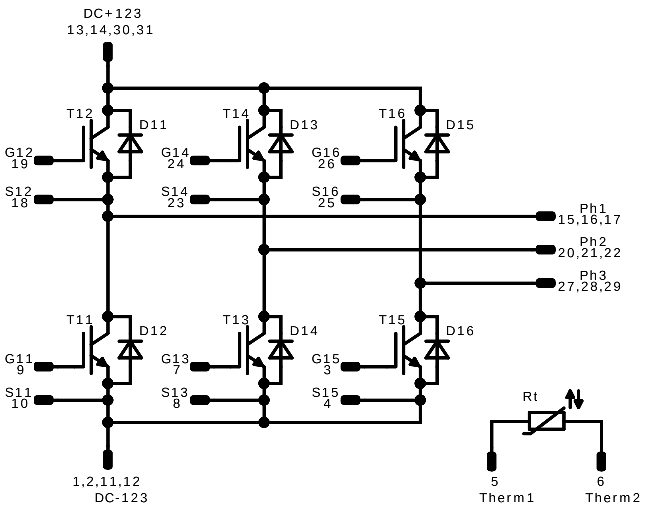
Outline

Pin table [mm]			
Pin	X	Y	Function
1	52,6	0	DC-
2	49,9	0	DC-
3	42,65	0	G6
4	39,65	0	S6
5	35,15	0	NTC1
6	28,4	0	NTC2
7	24	0	G4
8	21	0	S4
9	12,2	0	G2
10	9,2	0	S2
11	2,7	0	DC-
12	0	0	DC-
13	0	14,65	DC+
14	2,7	14,65	DC+
15	0	28,6	U
16	2,7	28,6	U
17	5,4	28,6	U
18	9,6	28,6	S1
19	12,6	28,6	G1
20	19,6	28,6	V
21	22,3	28,6	V
22	25	28,6	V
23	29,7	28,6	S3
24	32,7	28,6	G3
25	39,7	28,6	S5
26	42,7	28,6	G5
27	47,2	28,6	W
28	49,9	28,6	W
29	52,6	28,6	W
30	52,6	14,65	DC+
31	49,9	14,65	DC+



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
T11, T12, T13, T14, T15, T16	IGBT	650 V	50 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	650 V	50 A	Inverter 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.

Vincotech thermistor reference
See Vincotech thermistor reference table at 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-FY076PA050S501-L822F58-D1-14	21 Nov. 2023		

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