



Vincotech

80-M0066PA020SA-K645F10

datasheet

MiniSKiiP® PACK 0

600 V / 20 A

Features

- Sixpack topology
- Open emitter configuration
- Solder-free spring contact technology
- Integrated thermal sensor

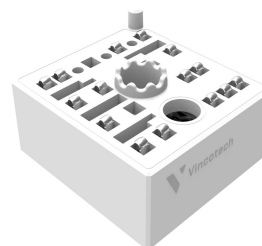
Target applications

- Embedded Drives
- Industrial Drives

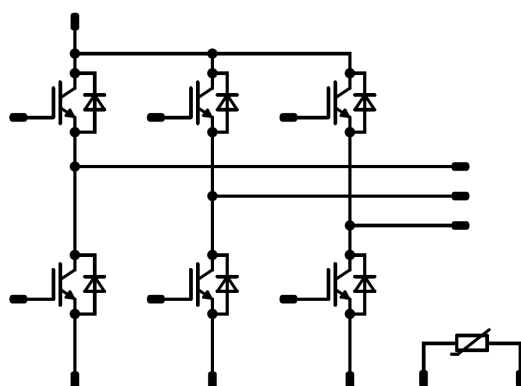
Types

- 80-M0066PA020SA-K645F10

MiniSKiiP® 0 16 mm housing



Schematic





Vincotech

80-M0066PA020SA-K645F10
datasheet

Maximum Ratings

$T_j = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		600	V
Collector current	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	27	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	62	W
Gate-emitter voltage	V_{GES}		± 20	V
Short circuit ratings	t_{SC}	$V_{GE} = 15\text{ V}$, $V_{CC} = 360\text{ V}$ $T_j = 150\text{ °C}$	6	μs
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

Inverter Diode

Peak repetitive reverse voltage	V_{RRM}		600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	26	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	40	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	43	W
Maximum junction temperature	T_{jmax}		175	$^{\circ}\text{C}$

Module Properties

Thermal Properties

Storage temperature	T_{stg}		-40...+125	$^{\circ}\text{C}$
Operation temperature under switching condition	T_{jop}		-40...+($T_{jmax} - 25$)	$^{\circ}\text{C}$

Isolation Properties

Isolation voltage	V_{isol}	DC Test Voltage* $t_p = 2\text{ s}$	5500	V
Isolation voltage	V_{isol}	AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance		With std lid For more informations see handling instructions	6,3	mm
Clearance		With std lid For more informations see handling instructions	6,3	mm
Comparative Tracking Index	CTI		≥ 200	

*100 % tested in production



Vincotech

80-M0066PA020SA-K645F10
datasheet

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	

Inverter Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0003	25	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		20	25 125	1,1	1,55 1,75	1,9	V
Collector-emitter cut-off current	I_{CES}		0	600		25			1,1	µA
Gate-emitter leakage current	I_{GES}		20	0		25			300	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	$f = 1 \text{ Mhz}$	0	25	25			1100		pF
Output capacitance	C_{oes}							71		pF
Reverse transfer capacitance	C_{res}							32		pF

Thermal

Thermal resistance junction to sink*	$R_{th(j-s)}$	$\lambda_{paste} = 2,5 \text{ W/mK}$ (HPTP)						1,53		K/W
--------------------------------------	---------------	--	--	--	--	--	--	------	--	-----

*Only valid with pre-applied Vincotech thermal interface material.

Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 16 \Omega$ $R_{goff} = 16 \Omega$	± 15	350	20	25 125 150		67,2 66,2 66,2		ns
Rise time	t_r					25 125 150		26 27,2 28		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		115,8 133,8 137,6		ns
Fall time	t_f					25 125 150		69,11 87,03 88,48		ns
Turn-on energy (per pulse)	E_{on}	$Q_{ifwd} = 0,87 \mu C$ $Q_{ifwd} = 1,64 \mu C$ $Q_{ifwd} = 1,91 \mu C$				25 125 150		0,45 0,624 0,677		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,426 0,578 0,613		mWs



Vincotech

80-M0066PA020SA-K645F10
datasheet

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	

Inverter Diode

Static

Forward voltage	V_F				20	25 125	1,25	1,71 1,58	1,95	V
Reverse leakage current	I_R	$V_r = 600$ V				25			27	μA

Thermal

Thermal resistance junction to sink*	$R_{th(j-s)}$	$\lambda_{paste} = 2,5$ W/mK (HPTP)						2,2		K/W
--------------------------------------	---------------	--	--	--	--	--	--	-----	--	-----

*Only valid with pre-applied Vincotech thermal interface material.

Dynamic

Peak recovery current	I_{RRM}	$di/dt=759$ A/μs $di/dt=802$ A/μs $di/dt=896$ A/μs	± 15	350	20	25 125 150		8,88 11,5 12,4		A
Reverse recovery time	t_{rr}					25 125 150		229,09 306,28 325,67		ns
Recovered charge	Q_r					25 125 150		0,87 1,64 1,91		μC
Reverse recovered energy	E_{rec}					25 125 150		0,221 0,407 0,477		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125 150		38,26 81,03 82,44		A/μs



Vincotech

80-M0066PA020SA-K645F10
datasheet

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		1		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	$R_{100} = 1670 \Omega$				100	-2		2	%
Maximum Current	I_{max}							3		mA
Power dissipation constant	d					25		0,76		mW/K
A-value	A							$7,635 \times 10^{-3}$		1/K
B-value	B							$1,73 \times 10^{-5}$		1/K ²
Vincotech Thermistor Reference									E	



Vincotech

80-M0066PA020SA-K645F10

datasheet

Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$

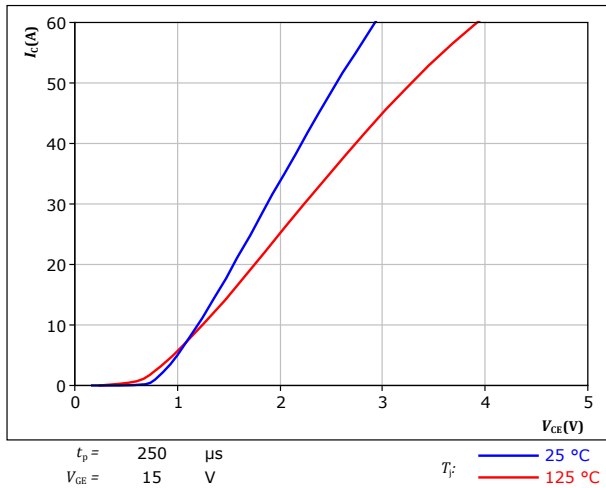


figure 2. IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$

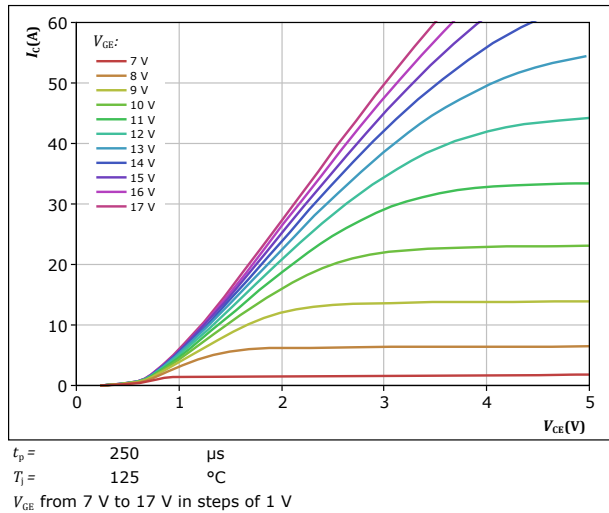


figure 3. IGBT

Typical transfer characteristics

$$I_C = f(V_{GE})$$

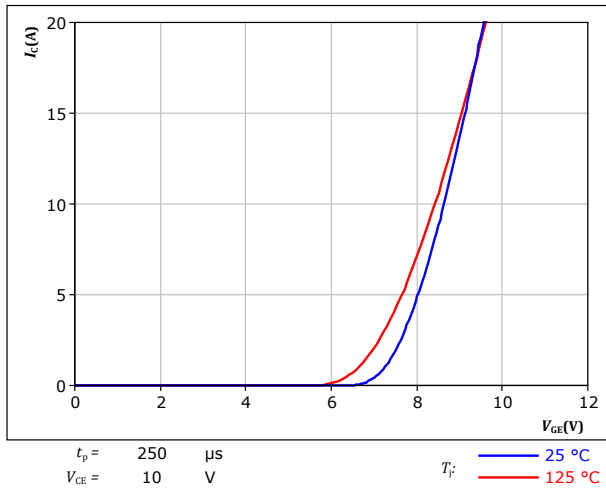
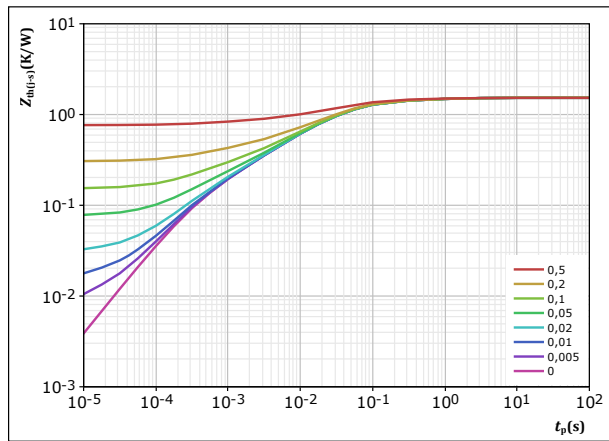


figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$R (K/W)$	$\tau (s)$
7,52E-02	1,56E+00
1,49E-01	2,41E-01
7,06E-01	4,40E-02
3,62E-01	9,85E-03
1,38E-01	2,12E-03
9,71E-02	3,56E-04



Vincotech

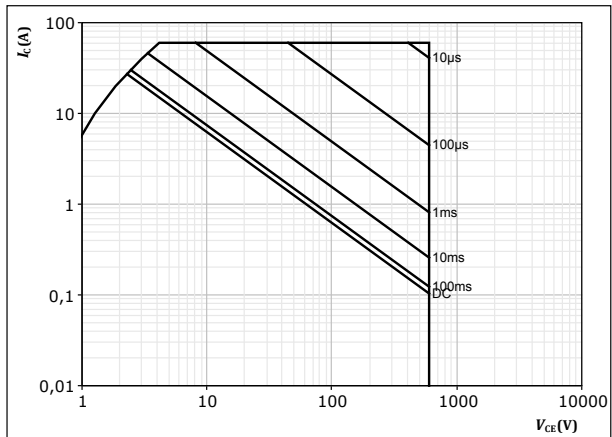
80-M0066PA020SA-K645F10
datasheet

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

$T_j = T_{jmax}$



Vincotech

80-M0066PA020SA-K645F10 datasheet

Inverter Diode Characteristics

figure 6.

FWD

Typical forward characteristics

$$I_F = f(V_F)$$

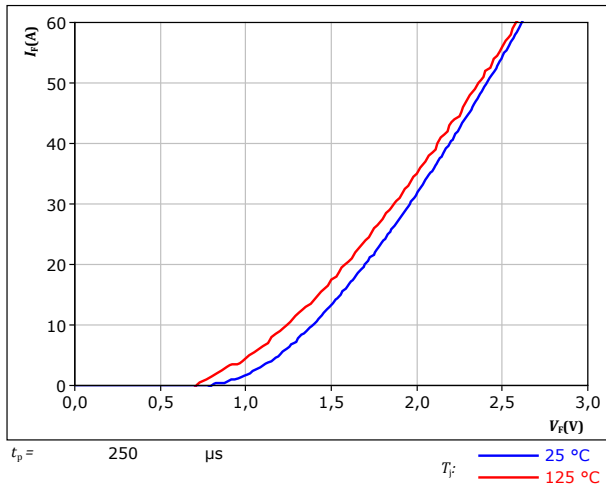
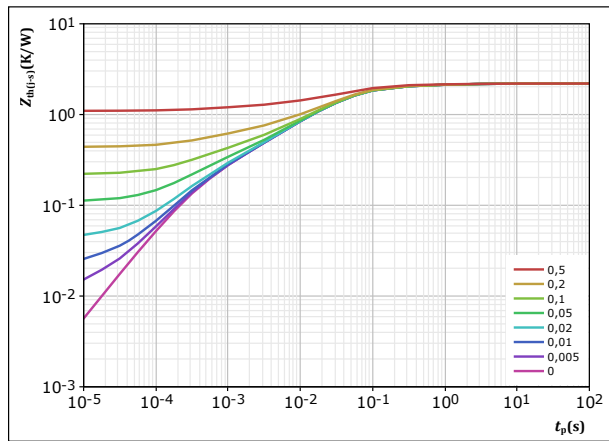


figure 7.

FWD

Transient thermal impedance as a function of pulse width

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



$D =$	t_p / T	
$R_{th(j-s)} =$	2,196	K/W
FWD thermal model values		
R (K/W)	τ (s)	
7,86E-02	2,51E+00	
1,61E-01	3,99E-01	
9,23E-01	5,50E-02	
5,97E-01	1,75E-02	
2,73E-01	3,11E-03	
1,63E-01	3,77E-04	



Vincotech

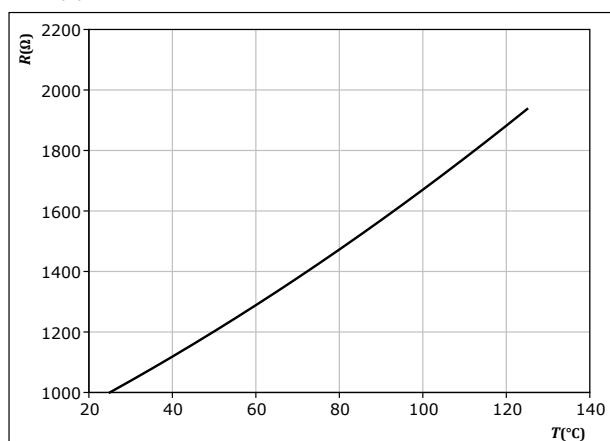
80-M0066PA020SA-K645F10
datasheet

Thermistor Characteristics

figure 8. Thermistor

Typical PTC characteristic as function of temperature

$$R_T = f(T)$$





Vincotech

80-M0066PA020SA-K645F10 datasheet

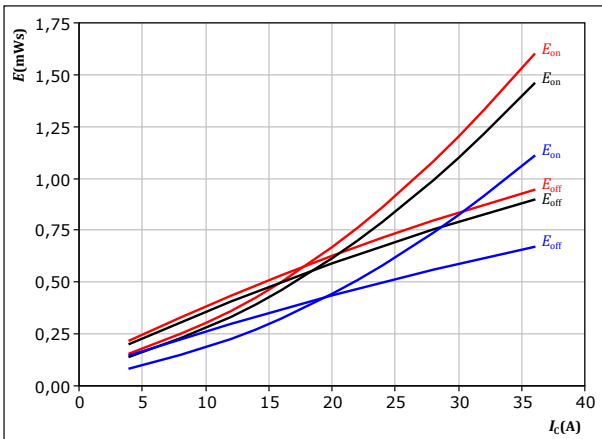
Inverter Switching Characteristics

figure 9.

IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_C)$$



With an inductive load at

$V_{CE} = 350 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 16 \text{ } \Omega$
 $R_{goff} = 16 \text{ } \Omega$

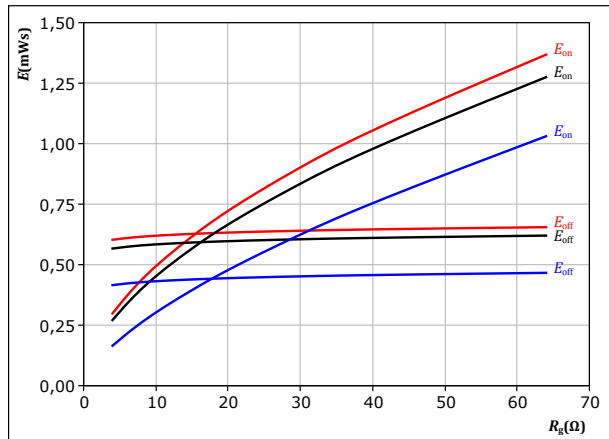
T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 10.

IGBT

Typical switching energy losses as a function of gate resistor

$$E = f(R_g)$$



With an inductive load at

$V_{CE} = 350 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_C = 20 \text{ A}$

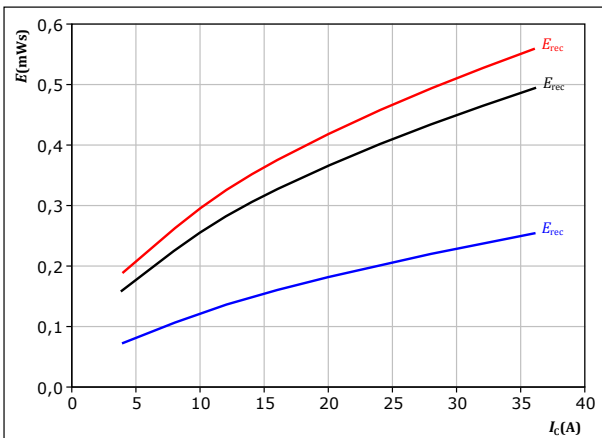
T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 11.

FWD

Typical reverse recovered energy loss as a function of collector current

$$E_{rec} = f(I_C)$$



With an inductive load at

$V_{CE} = 350 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 16 \text{ } \Omega$

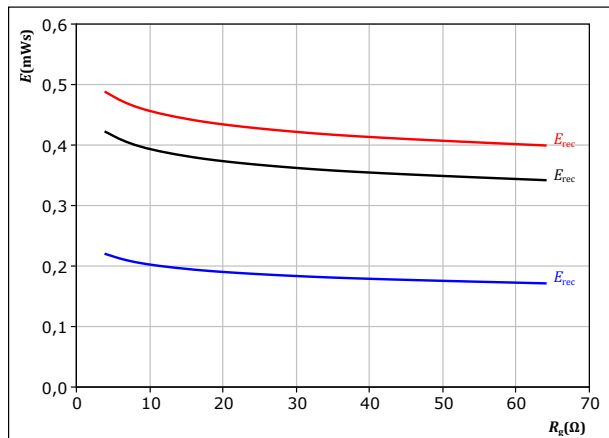
T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 12.

FWD

Typical reverse recovered energy loss as a function of gate resistor

$$E_{rec} = f(R_g)$$



With an inductive load at

$V_{CE} = 350 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_C = 20 \text{ A}$

T_j : 25 °C (blue), 125 °C (black), 150 °C (red)



Vincotech

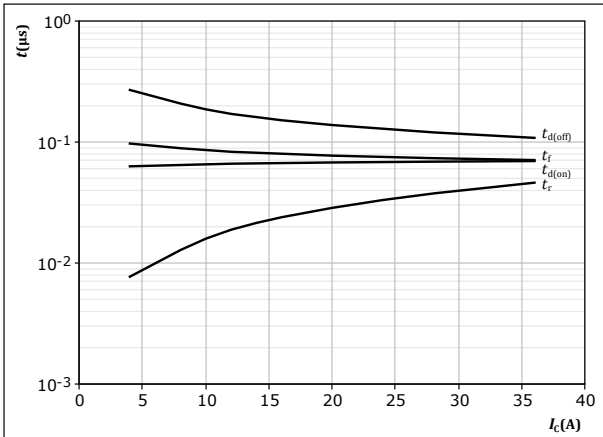
80-M0066PA020SA-K645F10
datasheet

Inverter Switching Characteristics

figure 13.

IGBT

Typical switching times as a function of collector current
 $t = f(I_C)$



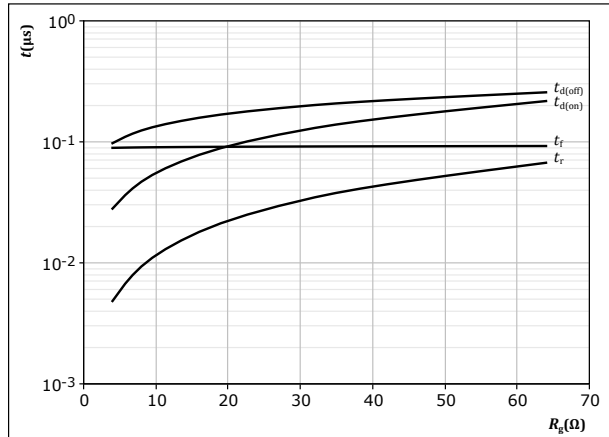
With an inductive load at

$T_j = 150 \text{ } ^\circ\text{C}$
 $V_{CE} = 350 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 16 \text{ } \Omega$
 $R_{goff} = 16 \text{ } \Omega$

figure 14.

IGBT

Typical switching times as a function of gate resistor
 $t = f(R_g)$



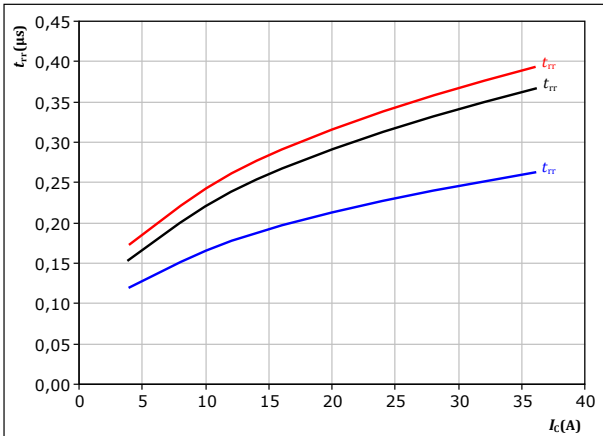
With an inductive load at

$T_j = 150 \text{ } ^\circ\text{C}$
 $V_{CE} = 350 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_C = 20 \text{ A}$

figure 15.

FWD

Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_C)$



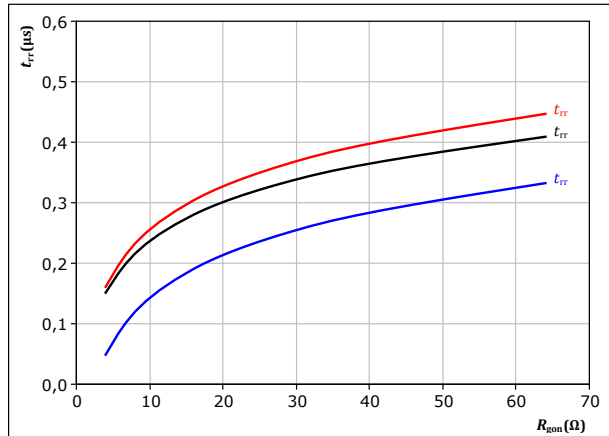
With an inductive load at

$V_{CE} = 350 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $R_{gon} = 16 \text{ } \Omega$
 $T_j: 25 \text{ } ^\circ\text{C}$
 $125 \text{ } ^\circ\text{C}$
 $150 \text{ } ^\circ\text{C}$

figure 16.

FWD

Typical reverse recovery time as a function of IGBT turn on gate resistor
 $t_{rr} = f(R_{gon})$



With an inductive load at

$V_{CE} = 350 \text{ V}$
 $V_{GE} = \pm 15 \text{ V}$
 $I_C = 20 \text{ A}$
 $T_j: 25 \text{ } ^\circ\text{C}$
 $125 \text{ } ^\circ\text{C}$
 $150 \text{ } ^\circ\text{C}$



Vincotech

80-M0066PA020SA-K645F10
datasheet

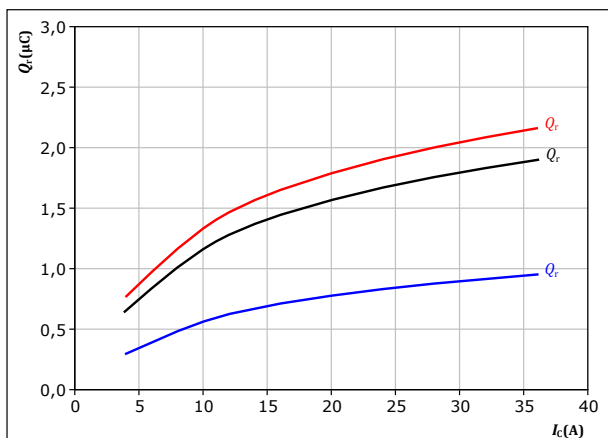
Inverter Switching Characteristics

figure 17.

FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

$V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω

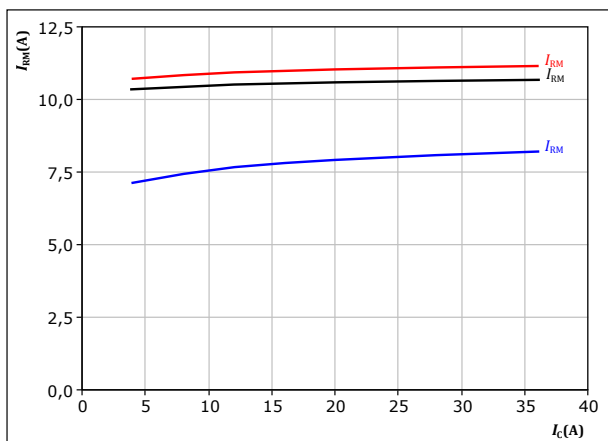
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 19.

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
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω

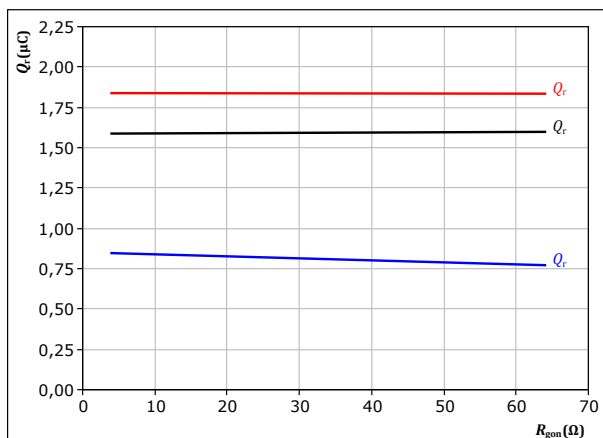
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 18.

FWD

Typical recovered charge as a function of turn on gate resistor

$$Q_r = f(R_{gon})$$



With an inductive load at

$V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $I_c = 20$ A

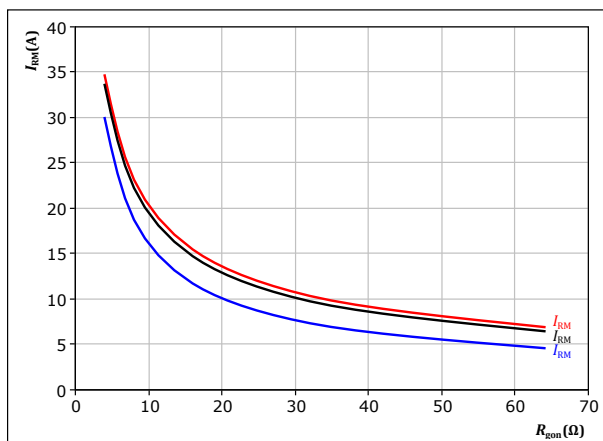
T_j :
— 25 °C
— 125 °C
— 150 °C

figure 20.

FWD

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

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



With an inductive load at

$V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $I_c = 20$ A

T_j :
— 25 °C
— 125 °C
— 150 °C



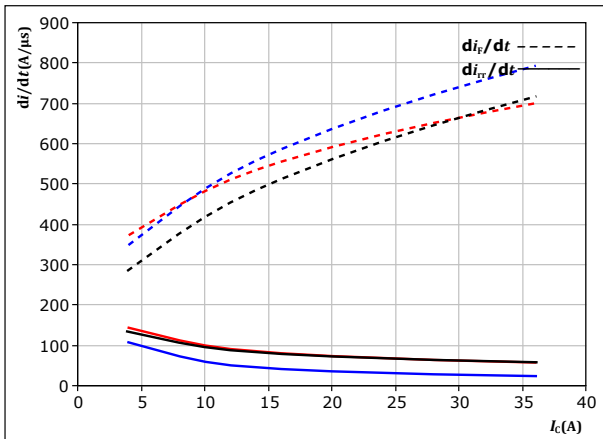
Vincotech

80-M0066PA020SA-K645F10
datasheet

Inverter Switching Characteristics

figure 21. FWD

Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_f/dt, di_r/dt = f(I_C)$



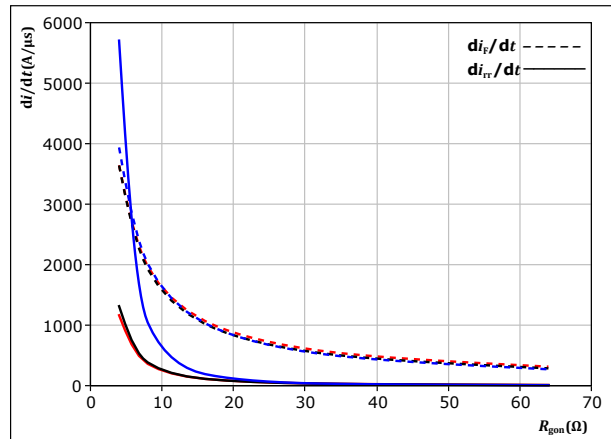
With an inductive load at

$V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω

T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 22. FWD

Typical rate of fall of forward and reverse recovery current as a function of turn on gate resistor
 $di_f/dt, di_r/dt = f(R_{gon})$



With an inductive load at

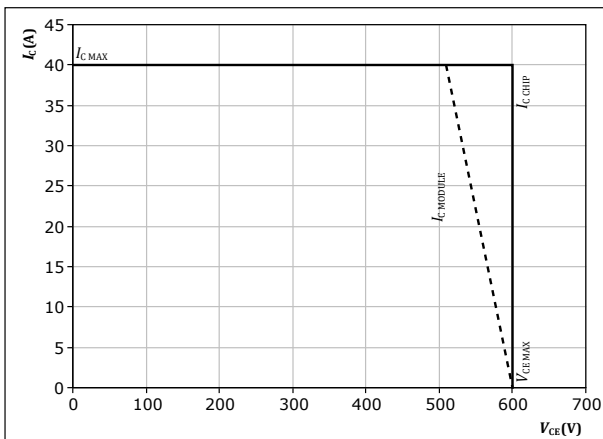
$V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $I_C = 20$ A

T_j : 25 °C (blue), 125 °C (black), 150 °C (red)

figure 23. IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At $T_j = 150$ °C
 $R_{gon} = 16$ Ω
 $R_{goff} = 16$ Ω



Vincotech

80-M0066PA020SA-K645F10

datasheet

Inverter Switching Definitions

figure 24. IGBT

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

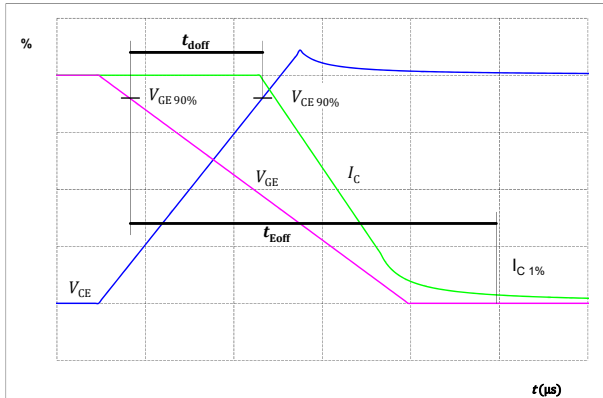


figure 25. IGBT

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

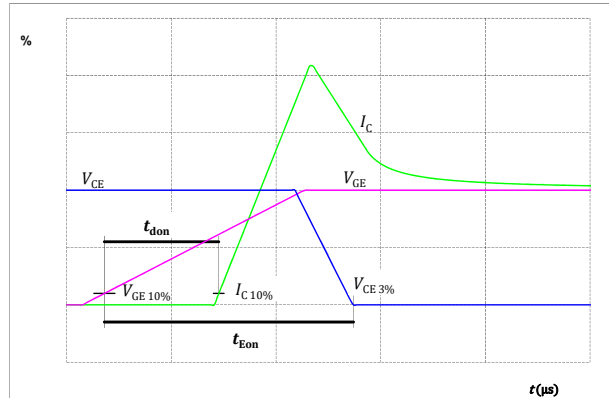


figure 26. IGBT

Turn-off Switching Waveforms & definition of t_f

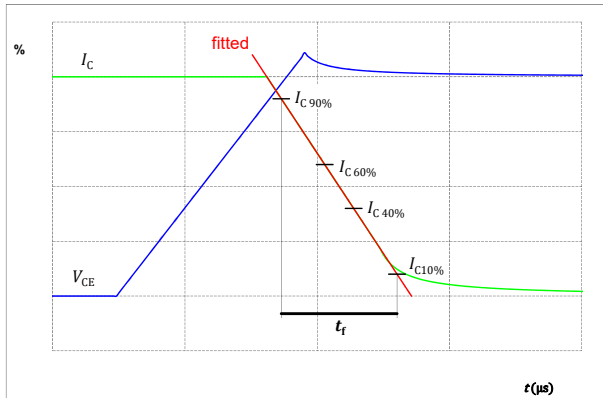
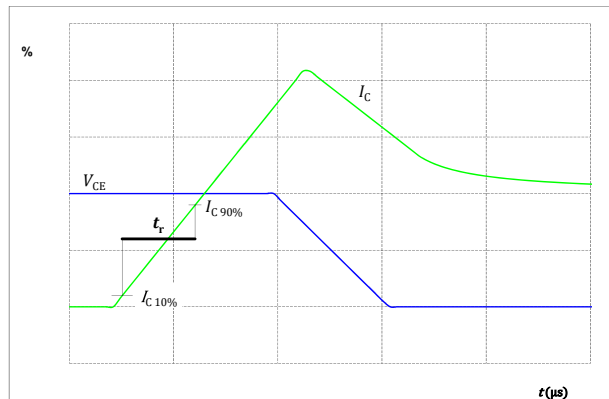


figure 27. IGBT

Turn-on Switching Waveforms & definition of t_r





Vincotech

Inverter Switching Definitions

figure 28.

FWD

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

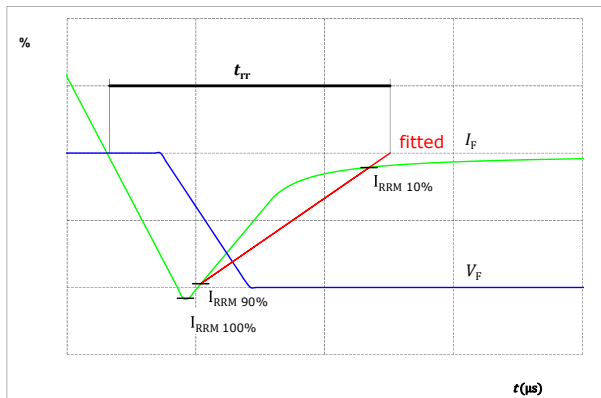
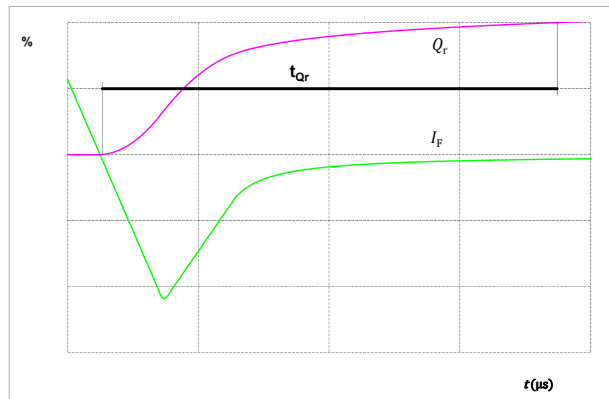


figure 29.

FWD

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





Vincotech

80-M0066PA020SA-K645F10

datasheet

Ordering Code	
Version	Ordering Code
With std lid (6.5mm height) + no thermal grease	80-M0066PA020SA-K645F10-/0A/
With thin lid (2.8mm height) + no thermal grease	80-M0066PA020SA-K645F10-/0B/
With std lid (6.5mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M0066PA020SA-K645F10-/1A/
With thin lid (2.8mm height) + thermal grease (0,8 W/mK, P12, silicone-based)	80-M0066PA020SA-K645F10-/1B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M0066PA020SA-K645F10-/4A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, TG20032, silicone-free)	80-M0066PA020SA-K645F10-/4B/
With std lid (6.5mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M0066PA020SA-K645F10-/5A/
With thin lid (2.8mm height) + thermal grease (2,5 W/mK, HPTP, silicone-based)	80-M0066PA020SA-K645F10-/5B/

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

Outline			
Pin table [mm]			
Pin	X	Y	Function
1	11,93	-11,5	G16
2	11,93	-6,9	Ph3
3	11,93	4,71	G15
4	11,93	8,3	Therm1
5	11,93	11,5	Therm2
6	4,33	-11,5	DC+123
7	not assembled		
8	4,33	6,95	G13
9	4,33	10,15	DC-3
10	-3,27	-11,5	G14
11	-3,27	-5,8	Ph2
12	not assembled		
13	-3,27	11,5	DC-2
14	-11,07	-11,5	G12
15	-11,07	-8,3	Ph1
16	not assembled		
17	-11,07	4,93	G11
18	-11,07	11,5	DC-1

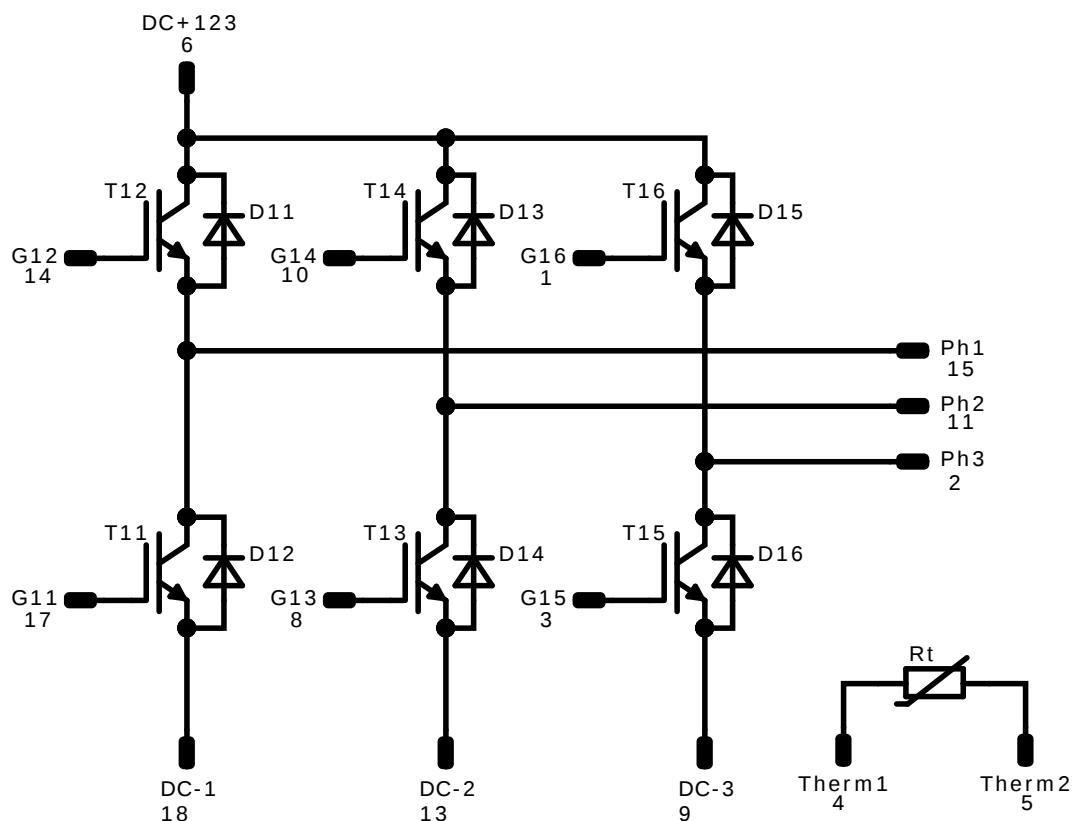
Pad positions refers to center point. For more informations on pad design please see package data



Vincotech

80-M0066PA020SA-K645F10
datasheet

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T11, T12, T13, T14, T15, T16	IGBT	600 V	20 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	600 V	20 A	Inverter Diode	
Rt	Thermistor			Thermistor	



Vincotech

80-M0066PA020SA-K645F10
datasheet

Packaging instruction				
Standard packaging quantity (SPQ) 198	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for MiniSKiiP® 0 packages see vincotech.com website.

Package data
Package data for MiniSKiiP® 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
80-M0066PA020SA-K645F10-D1-14	19 May. 2020		
80-M0066PA020SA-K645F10-D2-14	13 Jul. 2020	/3A/ and /3B/ removed from option code	16

DISCLAIMER

The information, specifications, procedures, methods and recommendations herein (together "information") are presented by Vincotech to reader in good faith, are believed to be accurate and reliable, but may well be incomplete and/or not applicable to all conditions or situations that may exist or occur. Vincotech reserves the right to make any changes without further notice to any products to improve reliability, function or design. No representation, guarantee or warranty is made to reader as to the accuracy, reliability or completeness of said information or that the application or use of any of the same will avoid hazards, accidents, losses, damages or injury of any kind to persons or property or that the same will not infringe third parties rights or give desired results. It is reader's sole responsibility to test and determine the suitability of the information and the product for reader's intended use.

LIFE SUPPORT POLICY

Vincotech products are not authorised for use as critical components in life support devices or systems without the express written approval of Vincotech.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.