
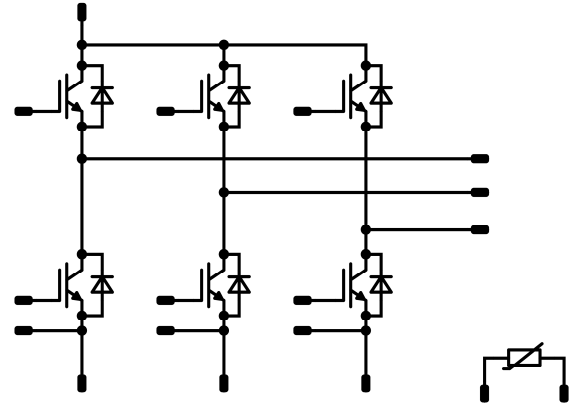




Vincotech

<i>flowPACK E1</i>	600 V / 20 A
<div style="background-color: #eee; padding: 5px; margin-bottom: 5px;">Features</div> <ul style="list-style-type: none"> Trenchstop™ IGBT3 technology Standard industrial housing Optimized $R_{th(j-s)}$ with Phase Change Material Built-in NTC 	<div style="background-color: #eee; padding: 5px; margin-bottom: 5px;">flow E1 12 mm housing</div> 
<div style="background-color: #eee; padding: 5px; margin-bottom: 5px;">Target applications</div> <ul style="list-style-type: none"> Industrial Drives 	<div style="background-color: #eee; padding: 5px; margin-bottom: 5px;">Schematic</div> 
<div style="background-color: #eee; padding: 5px; margin-bottom: 5px;">Types</div> <ul style="list-style-type: none"> 10-EZ066PA020SA-L853F38T 	

Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		600	V
Collector current	I_C		20	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	66	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	°C



Vincotech

Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
Inverter Diode				
Peak repetitive reverse voltage	V_{RRM}		600	V
Continuous (direct) forward current	I_F		20	A
Repetitive peak forward current	I_{FRM}		40	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	50	W
Maximum junction temperature	T_{jmax}		175	°C

Module Properties

General properties

Stray inductance	L_P		25	nH
------------------	-------	--	----	----

Thermal Properties

Storage temperature	T_{stg}		-40...+125	°C
Operation temperature under switching condition	T_{iop}		-40...(T _{jmax} - 25)	°C

Isolation Properties

Isolation voltage	V_{isol}	DC Test Voltage* $t_p = 2\text{ s}$	6000	V
		AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance			min. 12,7	mm
Clearance			8,62	mm
Comparative Tracking Index	CTI		≥ 600	

*100 % tested in production



Vincotech

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
		V_{GS} [V]	V_{GE} [V]	V_{DS} [V]	I_D [A]	I_C [A]	T_j [°C]	Min	Typ	

Inverter Switch

Static

Parameter	Symbol	Conditions	V_{GS} [V]	V_{GE} [V]	V_{DS} [V]	I_D [A]	I_C [A]	T_j [°C]	Min	Typ	Max	Unit
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$				0,00029	25		5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		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}									1100		pF
Output capacitance	C_{oes}	$f = 1$ Mhz	0	25		25				71		
Reverse transfer capacitance	C_{res}									32		

Thermal

Parameter	Symbol	Conditions	V_{GS} [V]	V_{GE} [V]	V_{DS} [V]	I_D [A]	I_C [A]	T_j [°C]	Min	Typ	Max	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)								1,44		K/W

Dynamic

Parameter	Symbol	Conditions	V_{GS} [V]	V_{GE} [V]	V_{DS} [V]	I_D [A]	I_C [A]	T_j [°C]	Min	Typ	Max	Unit		
Turn-on delay time	$t_{d(on)}$	$R_{gon} = 16$ Ω $R_{goff} = 16$ Ω				±15	350	20		67 66 66		ns		
Rise time	t_r		25							26 27 28				
Turn-off delay time	$t_{d(off)}$		25							116 134 138				
Fall time	t_f		25							69 87 88				
Turn-on energy (per pulse)*	E_{on}		$Q_{t-FWD} = 0,9$ μC							25	0,450			mWs
			$Q_{t-FWD} = 1,6$ μC							125	0,624			
		$Q_{t-FWD} = 1,9$ μC							150	0,677				
Turn-off energy (per pulse)*	E_{off}								25	0,426				
									125	0,578				
									150	0,613				

* $L_s = 14$ nH



Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
		V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max		

Inverter Diode

Static

Parameter	Symbol	V_{GS} [V]	V_{DS} [V]	I_D [A]	I_F [A]	T_j [°C]	Min	Typ	Max	Unit
Forward voltage	V_F			20		25 125		1,70 1,58	1,95	V
Reverse leakage current	I_R		600			25			27	µA

Thermal

Parameter	Symbol	Conditions	Value	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)	1,91	K/W

Dynamic

Parameter	Symbol	di/dt	V_{GS} [V]	V_{DS} [V]	I_D [A]	T_j [°C]	Min	Typ	Max	Unit
Peak recovery current	I_{RRM}				20	25 125 150		9 12 12		A
Reverse recovery time	t_{rr}				20	25 125 150		229 306 326		ns
Recovered charge	Q_r	$di/dt = 759$ A/µs $di/dt = 802$ A/µs $di/dt = 896$ A/µs	±15	350	20	25 125 150		0,870 1,64 1,91		µC
Reverse recovered energy	E_{rec}				20	25 125 150		0,221 0,407 0,477		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$				20	25 125 150		38 81 82		A/µs

Thermistor

Parameter	Symbol	Conditions	T_j [°C]	Min	Typ	Max	Unit
Rated resistance	R		25		5		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	$R_{100} = 493$ Ω	100	-5		+5	%
Power dissipation	P		25		245		mW
Power dissipation constant			25		1,4		mW/K
B-value	$B_{(25/50)}$	Tol. ±2 %	25		3375		K
B-value	$B_{(25/100)}$	Tol. ±2 %	25		3437		K
Vincotech NTC Reference						K	

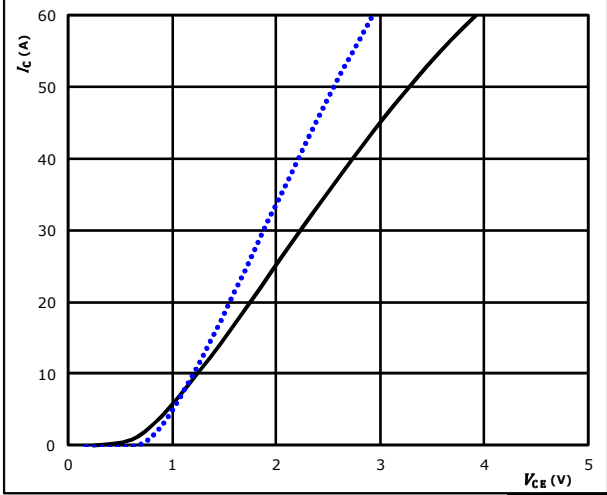


Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

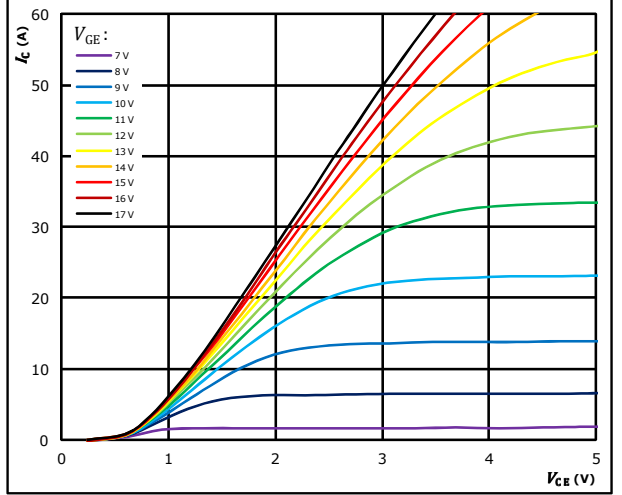


$t_p = 250 \mu s$ $T_j: 25 \text{ }^\circ C$ (dotted blue line)
 $V_{GE} = 15 V$ $T_j: 125 \text{ }^\circ C$ (solid black line)

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

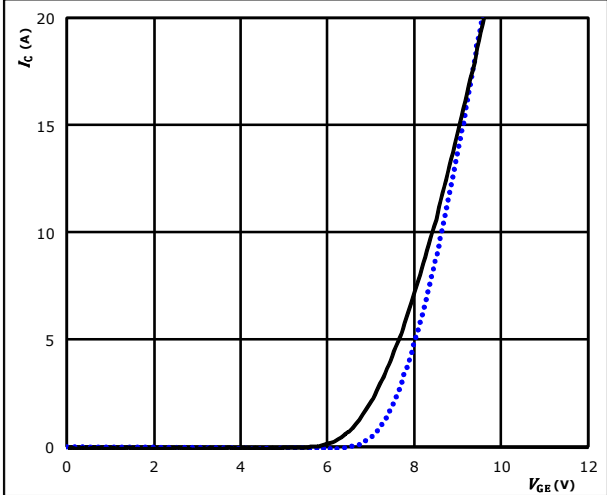


$t_p = 250 \mu s$
 $T_j = 125 \text{ }^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

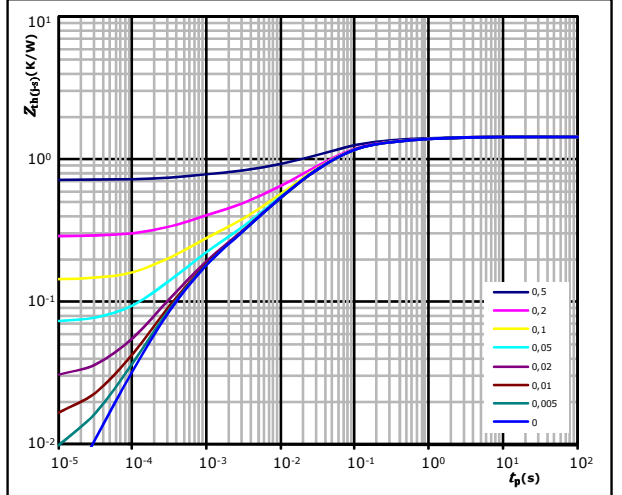


$t_p = 100 \mu s$ $T_j: 25 \text{ }^\circ C$ (dotted blue line)
 $V_{CE} = 10 V$ $T_j: 125 \text{ }^\circ C$ (solid black line)

figure 4. IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$
 $R_{th(j-s)} = 1,44 \text{ K/W}$

IGBT thermal model values

R (K/W)	τ (s)
7,44E-02	1,87E+00
1,73E-01	2,44E-01
6,82E-01	4,47E-02
2,86E-01	1,01E-02
1,12E-01	2,42E-03
1,15E-01	4,10E-04



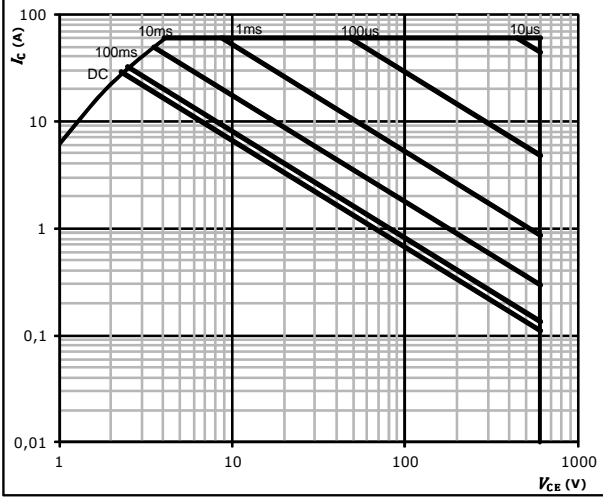
Vincotech

Inverter Switch Characteristics

figure 5. IGBT

Safe operating area

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



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



Inverter Diode Characteristics

figure 1. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

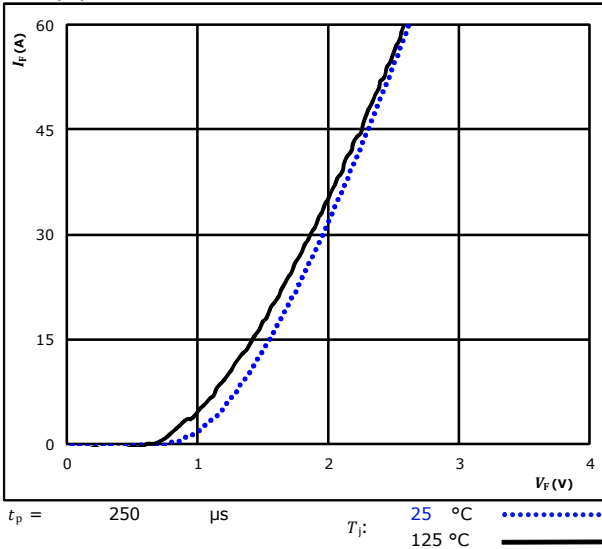
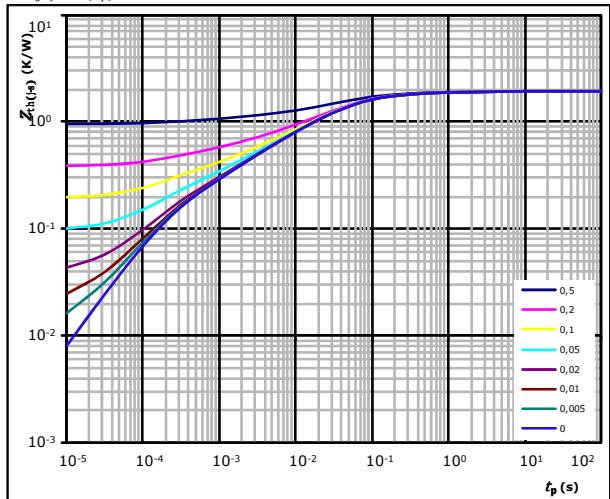


figure 2. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(\theta-s)} = 1,91 \text{ K/W}$
FWD thermal model values

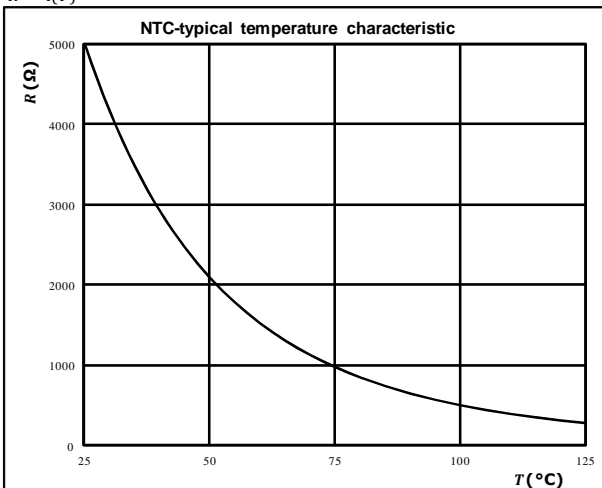
$R \text{ (K/W)}$	$\tau \text{ (s)}$
8,07E-02	2,12E+00
2,18E-01	2,13E-01
8,50E-01	4,23E-02
4,32E-01	8,96E-03
2,00E-01	1,53E-03
1,34E-01	2,03E-04

Thermistor Characteristics

figure 1. Thermistor

Typical NTC characteristic
as a function of temperature

$$R = f(T)$$

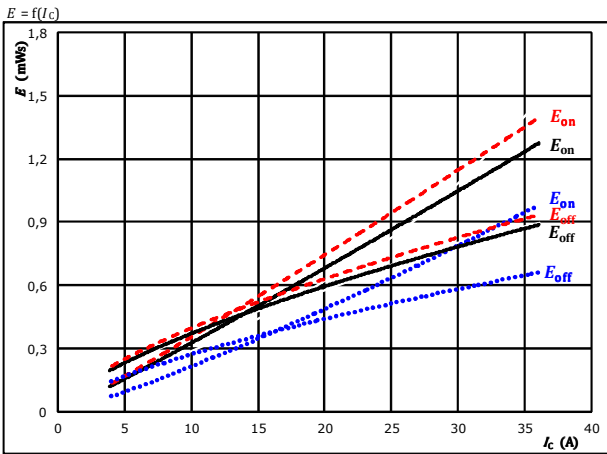




Inverter Switching Characteristics

figure 1. IGBT

Typical switching energy losses as a function of collector current

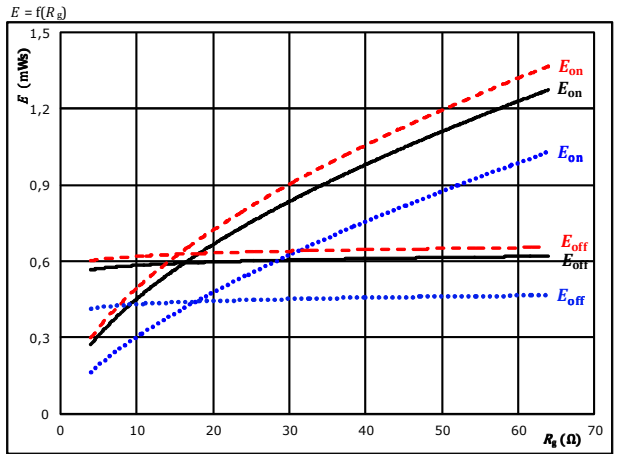


With an inductive load at
 $V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω
 $R_{goff} = 16$ Ω

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

figure 2. IGBT

Typical switching energy losses as a function of gate resistor

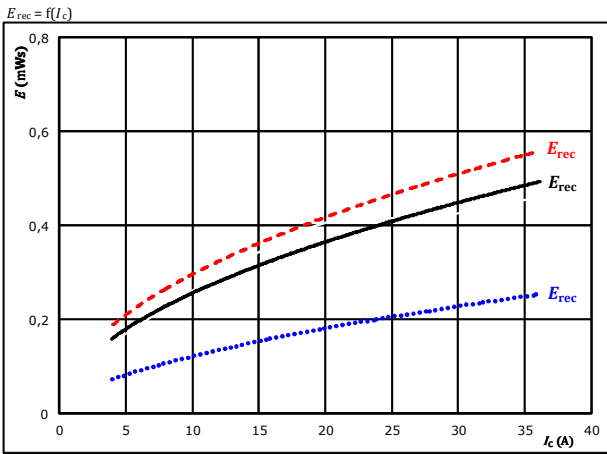


With an inductive load at
 $V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $I_c = 20$ A

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

figure 3. FWD

Typical reverse recovered energy loss as a function of collector current

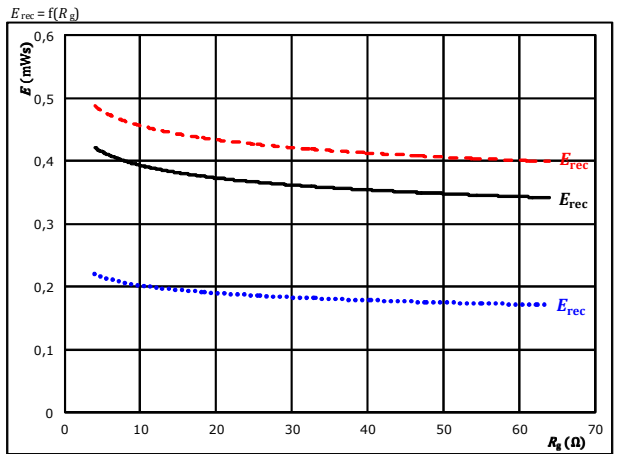


With an inductive load at
 $V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $R_{gon} = 16$ Ω

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

figure 4. FWD

Typical reverse recovered energy loss as a function of gate resistor



With an inductive load at
 $V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $I_c = 20$ A

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

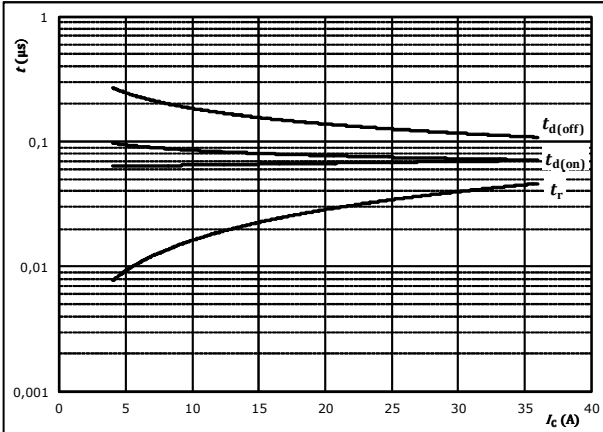


Inverter Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



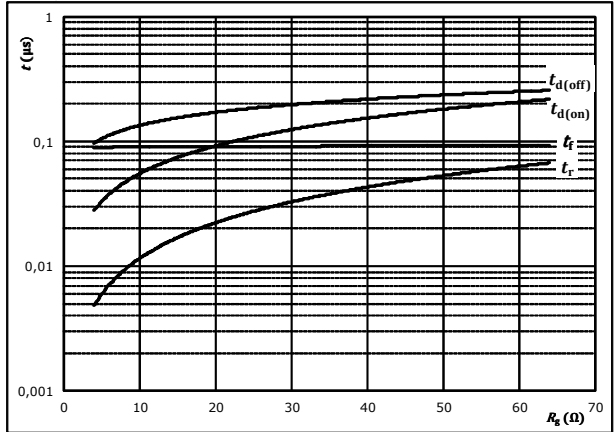
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$R_{g\text{on}} =$	16	Ω
$R_{g\text{off}} =$	16	Ω

figure 6. IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



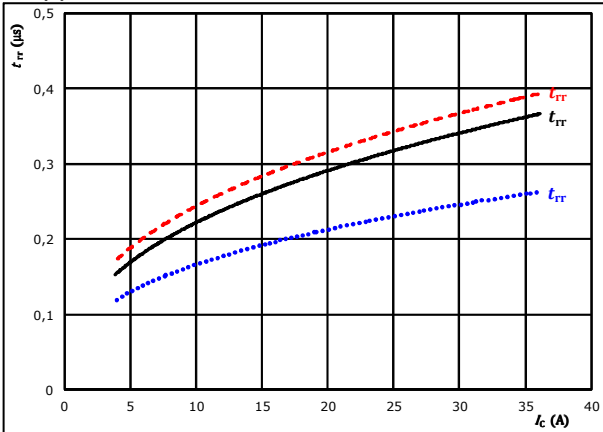
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$I_C =$	20	A

figure 7. FWD

Typical reverse recovery time as a function of collector current

$$t_{rr} = f(I_C)$$

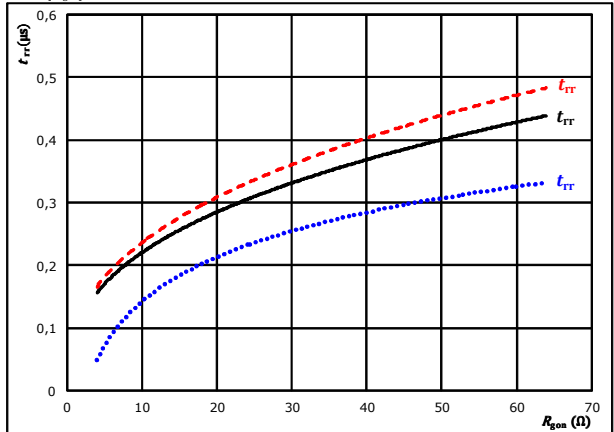


At	$V_{CE} =$	350	V	$T_j:$	25 °C
	$V_{GE} =$	±15	V		125 °C	————
	$R_{g\text{on}} =$	16	Ω		150 °C	-----

figure 8. FWD

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

$$t_{rr} = f(R_{g\text{on}})$$



At	$V_{CE} =$	350	V	$T_j:$	25 °C
	$V_{GE} =$	±15	V		125 °C	————
	$I_C =$	20	A		150 °C	-----

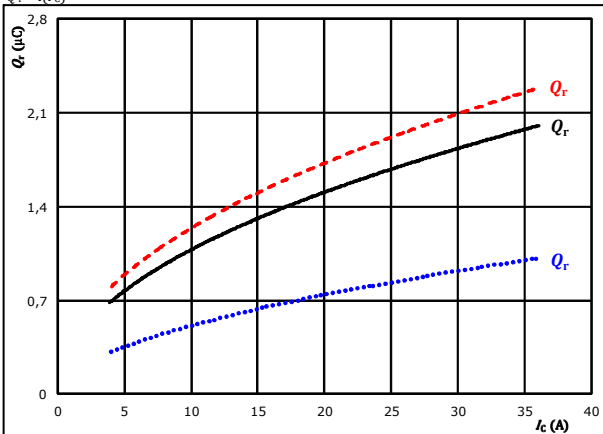


Inverter Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

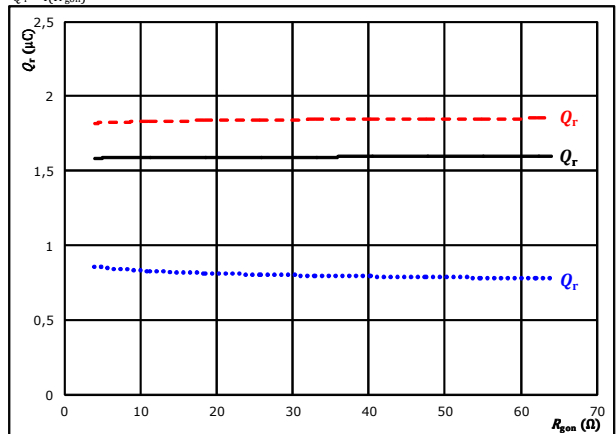


At $V_{CE} = 350$ V $T_j = 25$ °C $V_{GE} = \pm 15$ V $T_j = 125$ °C $R_{ggn} = 16$ Ω $T_j = 150$ °C

figure 10. FWD

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

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

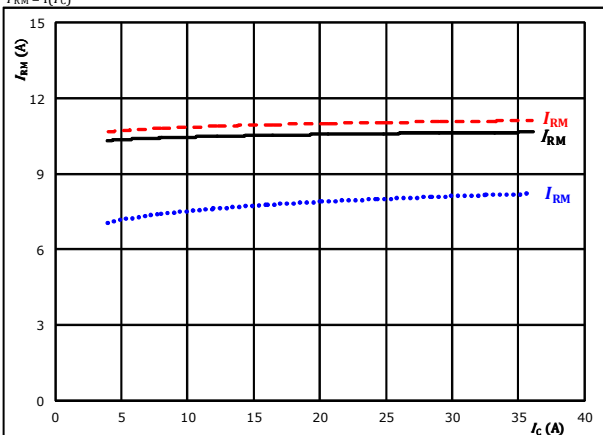


At $V_{CE} = 350$ V $T_j = 25$ °C $V_{GE} = \pm 15$ V $T_j = 125$ °C $I_c = 20$ A $T_j = 150$ °C

figure 11. FWD

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

$$I_{RM} = f(I_c)$$

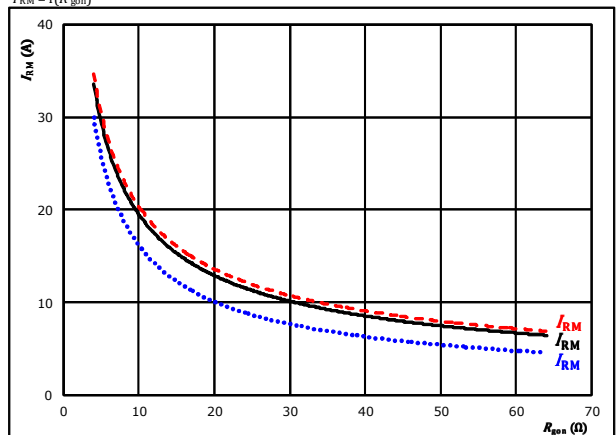


At $V_{CE} = 350$ V $T_j = 25$ °C $V_{GE} = \pm 15$ V $T_j = 125$ °C $R_{ggn} = 16$ Ω $T_j = 150$ °C

figure 12. FWD

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

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



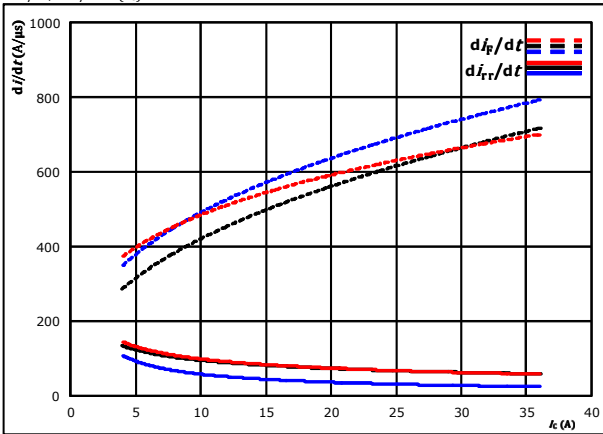
At $V_{CE} = 350$ V $T_j = 25$ °C $V_{GE} = \pm 15$ V $T_j = 125$ °C $I_c = 20$ A $T_j = 150$ °C



Inverter Switching Characteristics

figure 13. FWD

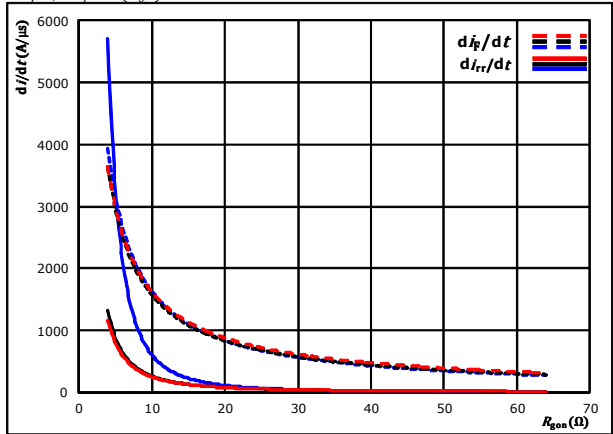
Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_f/dt, di_{rr}/dt = f(I_c)$



At $V_{CE} = 350$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C
 $R_{g(on)} = 16$ Ω $T_j = 150$ °C

figure 14. FWD

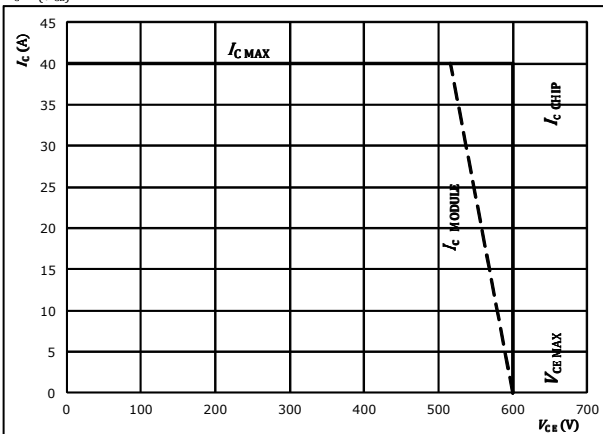
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
 $di_f/dt, di_{rr}/dt = f(R_{g(on)})$



At $V_{CE} = 350$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C
 $I_c = 20$ A $T_j = 150$ °C

figure 15. IGBT

Reverse bias safe operating area
 $I_c = f(V_{CE})$



At $T_j = 125$ °C
 $R_{g(on)} = 16$ Ω
 $R_{g(off)} = 16$ Ω

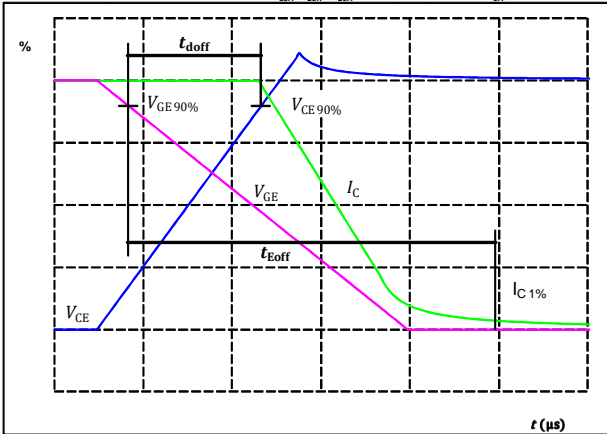


Inverter Switching Definitions

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

figure 1. IGBT

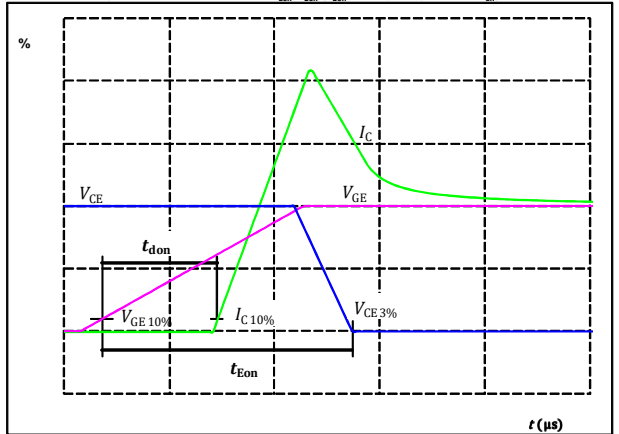
Turn-off Switching Waveforms & definition of t_{doff} , t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	20	A
$t_{doff} =$	134	ns

figure 2. IGBT

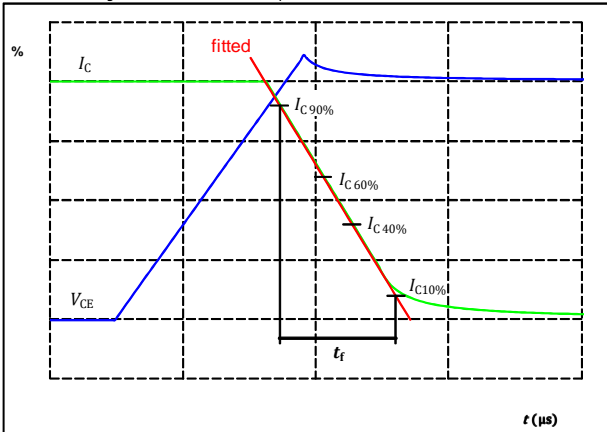
Turn-on Switching Waveforms & definition of t_{don} , t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	20	A
$t_{don} =$	66	ns

figure 3. IGBT

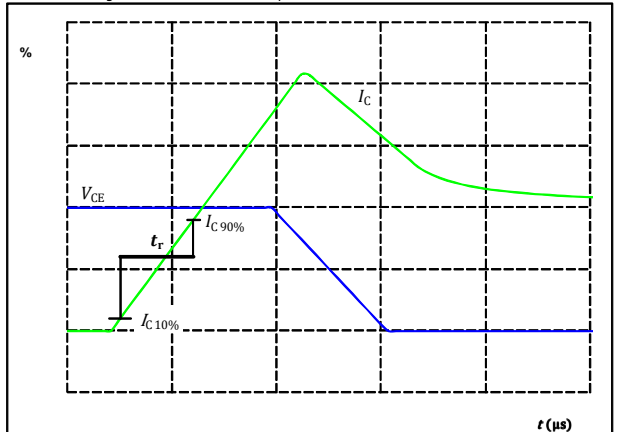
Turn-off Switching Waveforms & definition of t_r



$V_C(100\%) =$	350	V
$I_C(100\%) =$	20	A
$t_r =$	87	ns

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r



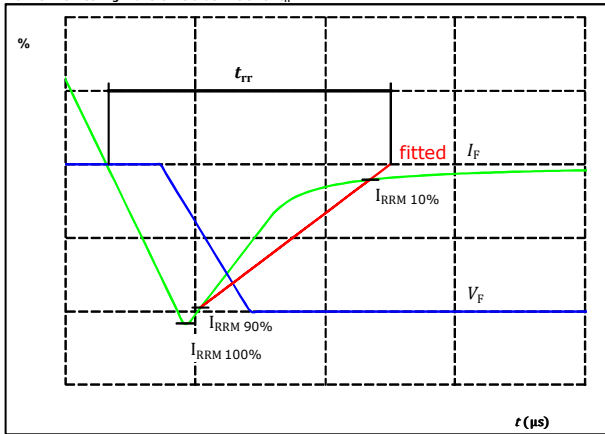
$V_C(100\%) =$	350	V
$I_C(100\%) =$	20	A
$t_r =$	27	ns



Vincotech

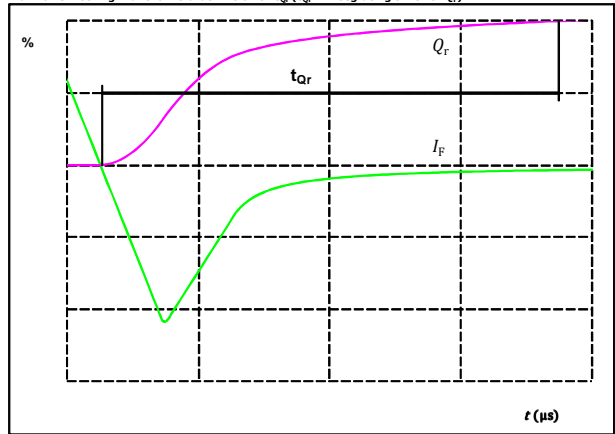
Inverter Switching Characteristics

figure 5. FWD
Turn-off Switching Waveforms & definition of t_{rr}



$V_F(100\%) =$	350	V
$I_F(100\%) =$	20	A
$I_{RRM}(100\%) =$	12	A
$t_{rr} =$	306	ns

figure 6. FWD
Turn-on Switching Waveforms & definition of t_{qr} ($t_{qr} =$ integrating time for Q_r)



$I_F(100\%) =$	20	A
$Q_r(100\%) =$	1,64	μC



Vincotech

Ordering Code & Marking								
Version			Ordering Code					
without thermal paste 12 mm housing with press-fit pins			10-EZ066PA020SA-L853F38T					
with thermal paste 12 mm housing with press-fit pins			10-EZ066PA020SA-L853F38T-/3/					
NN-NNNNNNNNNNNN TTTTITVV WWYY UL VIN LLLLL SSSS			Text	Name	Date code	UL & VIN	Lot	Serial
				NN-NNNNNNNNNNNN-TTTTITVV	WWYY	UL VIN	LLLLL	SSSS
			Datamatrix	Type&Ver	Lot number	Serial	Date code	
			TTTTITVV	LLLLL	SSSS	WWYY		

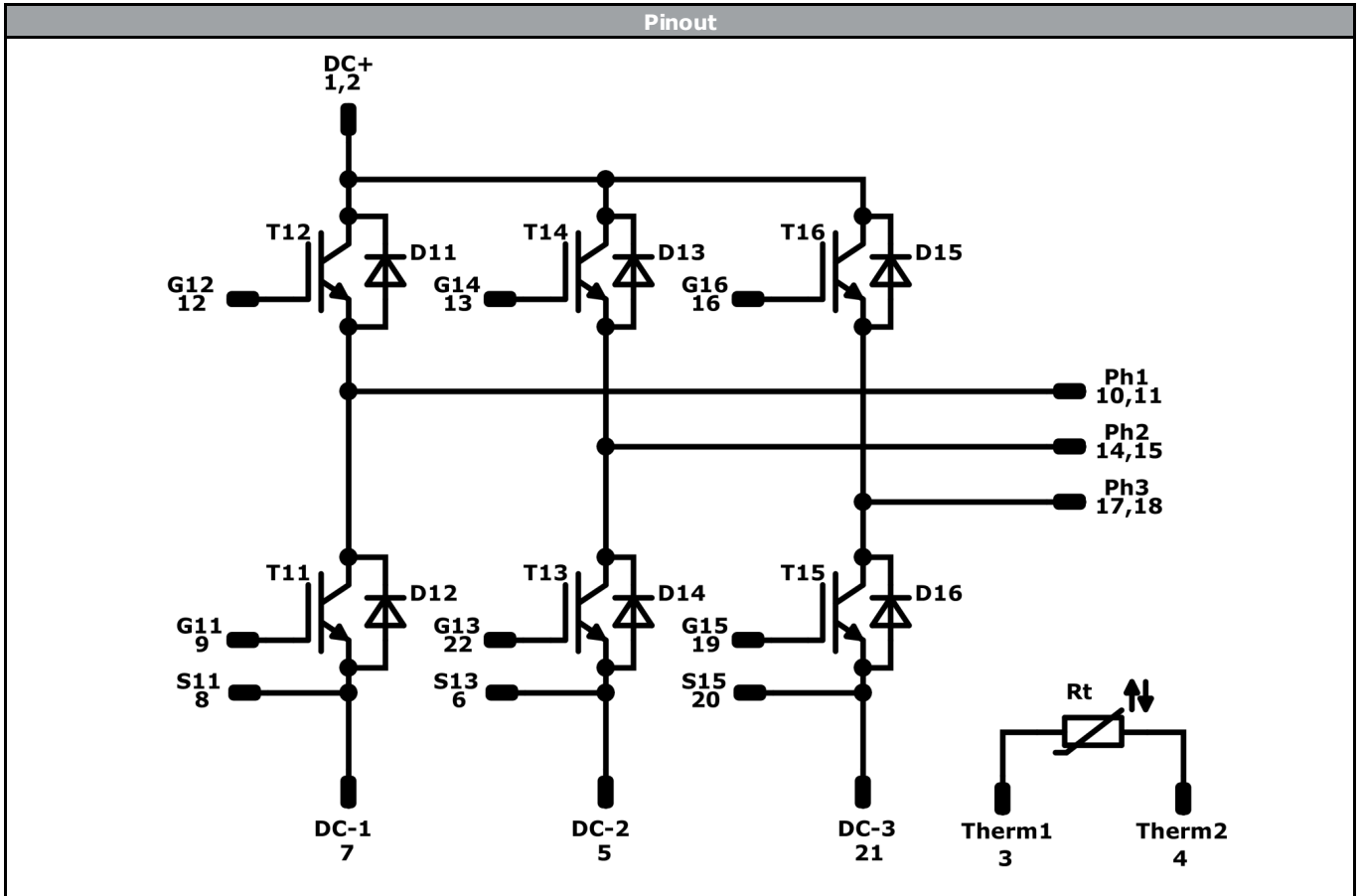
Pin table			
Pin	X	Y	Function
1	12,8	9,6	DC+
2	16	9,6	DC+
3	22,4	9,6	Therm1
4	25,6	9,6	Therm2
5	32	9,6	DC-2
6	32	6,4	S13
7	32	3,2	DC-1
8	32	0	S11
9	28,8	0	G11
10	6,4	0	Ph1
11	3,2	0	Ph1
12	0	0	G12
13	0	6,4	G14
14	0	16	Ph2
15	0	19,2	Ph2
16	0	25,6	G16
17	3,2	25,6	Ph3
18	6,4	25,6	Ph3
19	28,8	25,6	G15
20	32	25,6	S15
21	32	22,4	DC-3
22	32	16	G13

center of press-fit pinhead
for connection parameter see the handling instruction

Tolerance of pinpositions: ±0.4mm at the end of pins
Dimension of coordinate axis is only offset without tolerance



Vincotech



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	NTC			Thermistor	




Vincotech

Packaging instruction			
Standard packaging quantity (SPQ) 100	>SPQ	Standard	<SPQ Sample

Handling instruction
Handling instructions for <i>flow</i> E1 packages see vincotech.com website.

Package data
Package data for <i>flow</i> E1 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-EZ066PA020SA-L853F38T-D1-14	25 Jun. 2018		

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.