



Vincotech

**10-EZ066PA050SA-L855F38T**  
**10-E1066PA050SA-L855F38Z**  
 datasheet

<i>flowPACK E1</i>	600 V / 50 A
<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center; background-color: #ccc; margin: 0;"><b>Features</b></p> <ul style="list-style-type: none"> <li>Trenchstop™ IGBT3 technology</li> <li>Standard industrial housing</li> <li>Optimized <math>R_{th(j-s)}</math> with Phase Change Material</li> <li>Built-in NTC</li> </ul> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center; background-color: #ccc; margin: 0;"><b>Target applications</b></p> <ul style="list-style-type: none"> <li>Industrial Drives</li> </ul> </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; background-color: #ccc; margin: 0;"><b>Types</b></p> <ul style="list-style-type: none"> <li>10-EZ066PA050SA-L855F38T</li> <li>10-E1066PA050SA-L855F38Z</li> </ul> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center; background-color: #ccc; margin: 0;"><i>flow E1 12 mm housing</i></p> <div style="display: flex; justify-content: space-around; align-items: center;"> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <span>Press-fit pin</span> <span>Solder pin</span> </div> </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; background-color: #ccc; margin: 0;"><b>Schematic</b></p> </div>

## Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
<b>Inverter Switch</b>				
Collector-emitter voltage	$V_{CES}$		600	V
Collector current	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	51	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	150	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	95	W
Gate-emitter voltage	$V_{GES}$		±20	V
Short circuit ratings	$t_{SC}$	$V_{GE} = 15\text{ V}$ $V_{CE} = 360\text{ V}$ $T_j = 150\text{ °C}$	6	µs
Maximum junction temperature	$T_{jmax}$		175	°C



## Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
<b>Inverter Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		600	V
Continuous (direct) forward current	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	46	A
Repetitive peak forward current	$I_{FRM}$		100	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	67	W
Maximum junction temperature	$T_{jmax}$		175	°C

## Module Properties

### General Properties

Stray inductance	$L_P$		25	nH
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### 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* $t_p = 2\text{ s}$	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



### Characteristic Values

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

#### Inverter Switch

##### Static

Parameter	Symbol	Conditions	$V_{GS}$ [V]	$V_{GE}$ [V]	$V_{DS}$ [V]	$I_D$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$				0,0008	25	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CEsat}$		15			50	25 125 150	1,05	1,57 1,76 1,80	1,85	V
Collector-emitter cut-off current	$I_{CES}$		0	600			25			2,6	μA
Gate-emitter leakage current	$I_{GES}$		20	0			25			600	nA
Internal gate resistance	$r_g$								none		Ω
Input capacitance	$C_{ies}$								3140		pF
Output capacitance	$C_{oes}$	$f = 1 \text{ Mhz}$	0	25		25			200		
Reverse transfer capacitance	$C_{res}$								93		

##### Thermal

Parameter	Symbol	Conditions	$V_{GS}$ [V]	$V_{GE}$ [V]	$V_{DS}$ [V]	$I_D$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)							1,00		K/W

##### Dynamic

Parameter	Symbol	Conditions	$V_{GS}$ [V]	$V_{GE}$ [V]	$V_{DS}$ [V]	$I_D$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Turn-on delay time	$t_{d(on)}$	$R_{gon} = 8 \Omega$ $R_{goff} = 8 \Omega$	±15	300	50			25	95		ns
Rise time	$t_r$							150	100		
Turn-off delay time	$t_{d(off)}$							25	14		
Fall time	$t_f$							150	18		
Turn-on energy (per pulse)*	$E_{on}$	$Q_{FWD} = 2,3 \mu\text{C}$ $Q_{FWD} = 4,4 \mu\text{C}$						25	0,675		mWs
Turn-off energy (per pulse)*	$E_{off}$							150	1,02		
								25	1,30		
								150	1,76		

\*  $L_s = 14 \text{ nH}$



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## 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	$V_{GE}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Forward voltage	$V_F$			50	25 125 150		1,64 1,56 1,54	1,9	V
Reverse leakage current	$I_R$		600		25			27	μA

#### Thermal

Parameter	Symbol	Conditions	Value	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)	1,41	K/W

#### Dynamic

Parameter	Symbol	$V_{GE}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Peak recovery current	$I_{RRM}$				25 150		52 62		A
Reverse recovery time	$t_{rr}$				25 150		130 172		ns
Recovered charge	$Q_r$	$di/dt = 3939 \text{ A}/\mu\text{s}$ $di/dt = 3496 \text{ A}/\mu\text{s}$	$\pm 15$	300	50	25 150	2,29 4,37		μC
Reverse recovered energy	$E_{rec}$				25 150		0,515 0,92		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$				25 150		3909 2375		A/μs

### Thermistor

Parameter	Symbol	Conditions	Value	Unit
Rated resistance	$R$		5	kΩ
Deviation of $R_{100}$	$\Delta_{R/R}$	$R_{100} = 493 \Omega$	-5	+5 %
Power dissipation	$P$		245	mW
Power dissipation constant			1,4	mW/K
B-value	$B_{(25/50)}$	Tol. $\pm 2 \%$	3375	K
B-value	$B_{(25/100)}$	Tol. $\pm 2 \%$	3437	K
Vincotech NTC Reference				K

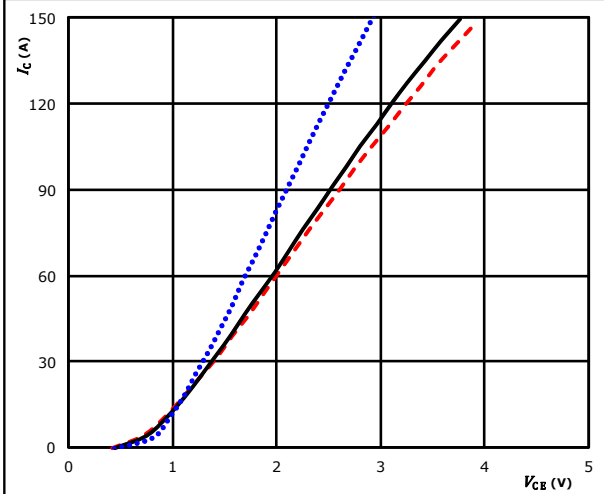


## Inverter Switch Characteristics

**figure 1.** IGBT

Typical output characteristics

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

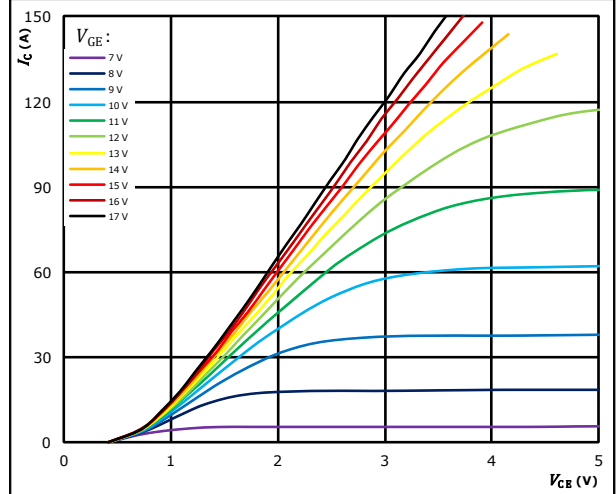


$t_p = 250 \mu s$        $T_j: 25 \text{ }^\circ C$       .....  
 $V_{GE} = 15 \text{ V}$        $T_j: 125 \text{ }^\circ C$       ———  
                                   $T_j: 150 \text{ }^\circ C$       - - - -

**figure 2.** IGBT

Typical output characteristics

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

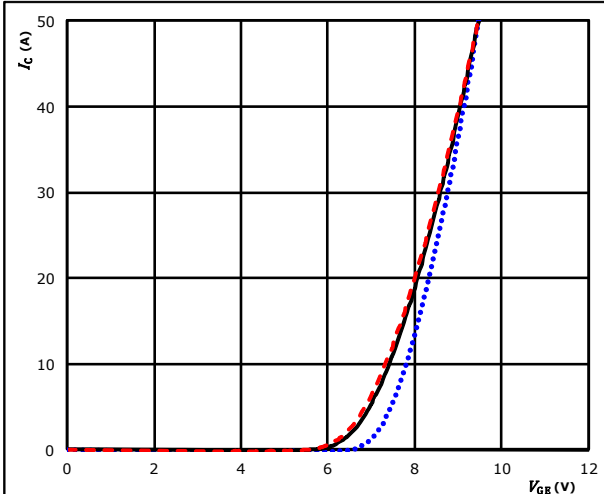


$t_p = 250 \mu s$        $T_j = 150 \text{ }^\circ C$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

**figure 3.** IGBT

Typical transfer characteristics

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

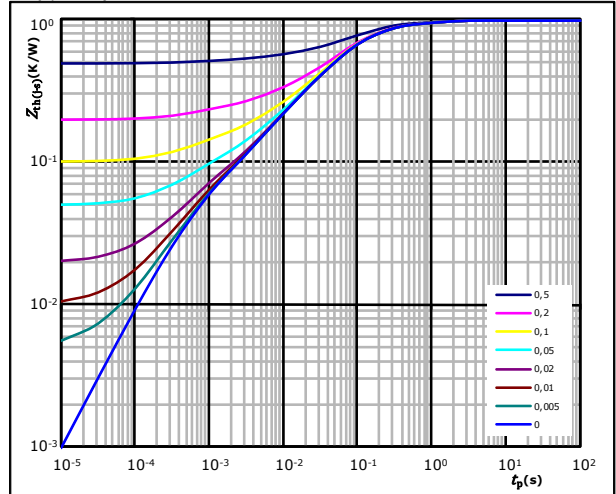


$t_p = 100 \mu s$        $T_j: 25 \text{ }^\circ C$       .....  
 $V_{CE} = 10 \text{ V}$        $T_j: 125 \text{ }^\circ C$       ———  
                                   $T_j: 150 \text{ }^\circ C$       - - - -

**figure 4.** IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$   
 $R_{th(j-s)} = 1,00 \text{ K/W}$

IGBT thermal model values

R (K/W)	$\tau$ (s)
1,45E-01	7,02E-01
5,28E-01	9,42E-02
2,00E-01	2,95E-02
8,09E-02	5,41E-03
4,17E-02	5,79E-04

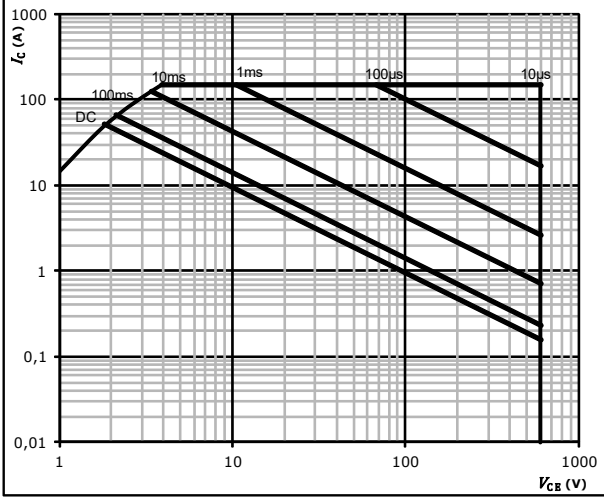


### Inverter Switch Characteristics

**figure 5. IGBT**

Safe operating area

$I_C = f(V_{CE})$



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

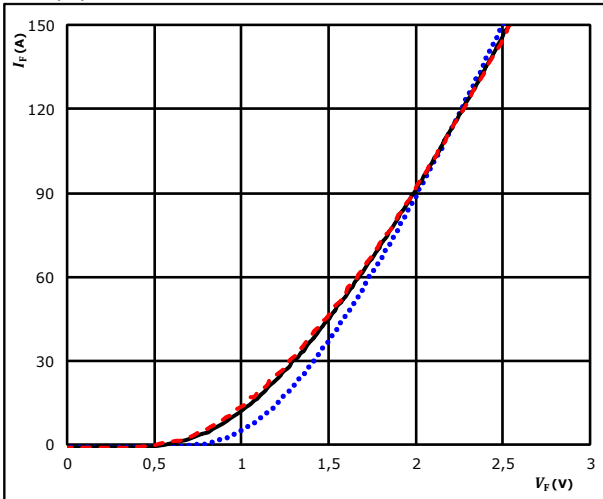


## Inverter Diode Characteristics

**figure 1.** **FWD**

Typical forward characteristics

$$I_F = f(V_F)$$

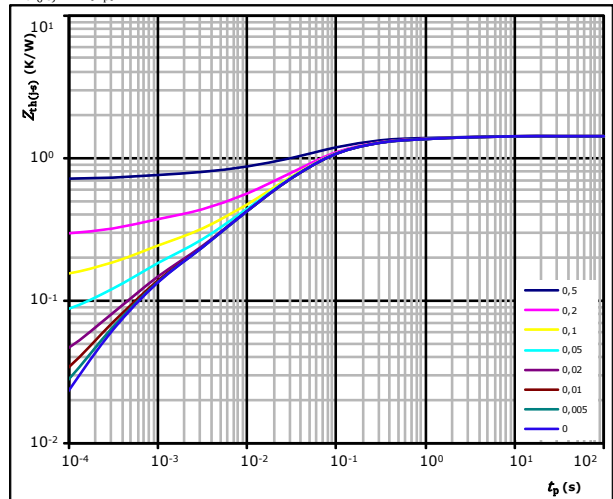


$t_p = 250 \mu s$   $T_j$ : 25 °C .....  
 125 °C ———  
 150 °C - - - -

**figure 2.** **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 1,41 \text{ K/W}$   
 FWD thermal model values

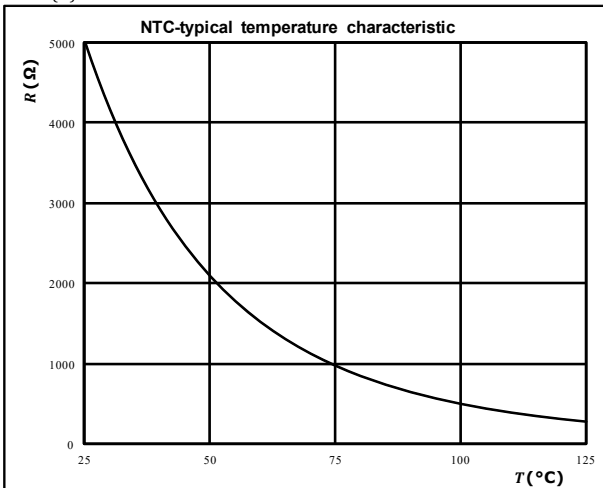
$R$ (K/W)	$\tau$ (s)
7,38E-02	2,82E+00
1,47E-01	4,00E-01
6,53E-01	7,18E-02
3,22E-01	2,02E-02
1,24E-01	4,33E-03
9,40E-02	4,82E-04

## Thermistor Characteristics

**figure 1.** **Thermistor**

Typical NTC characteristic as a function of temperature

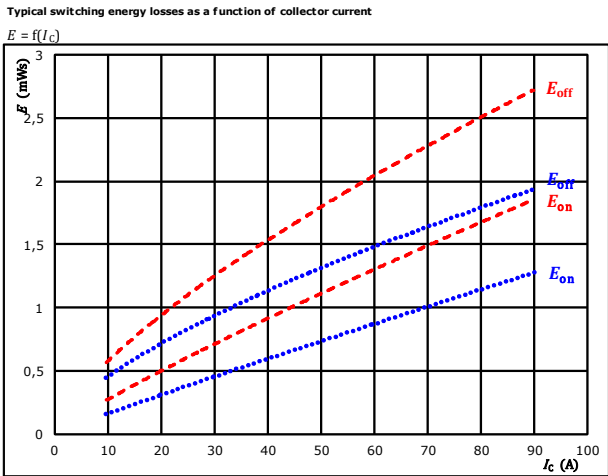
$$R = f(T)$$





## Inverter Switching Characteristics

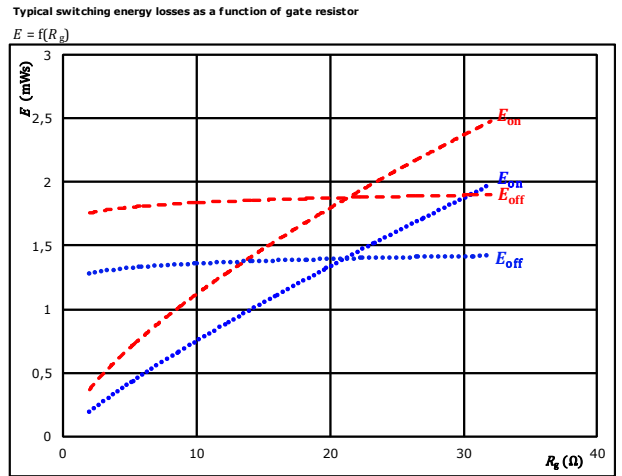
**figure 1.** IGBT



With an inductive load at  
 $V_{CE} = 300$  V  
 $V_{GE} = \pm 15$  V  
 $R_{g\text{on}} = 8$   $\Omega$   
 $R_{g\text{off}} = 8$   $\Omega$

$T_j$ : 25 °C (blue dotted), 150 °C (red dashed)

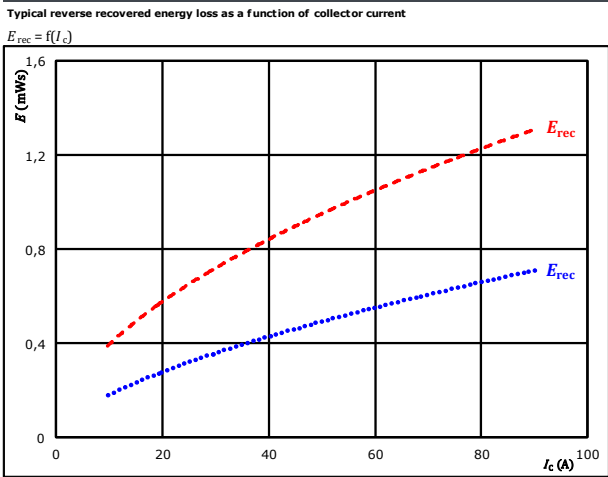
**figure 2.** IGBT



With an inductive load at  
 $V_{CE} = 300$  V  
 $V_{GE} = \pm 15$  V  
 $I_C = 50$  A

$T_j$ : 25 °C (blue dotted), 150 °C (red dashed)

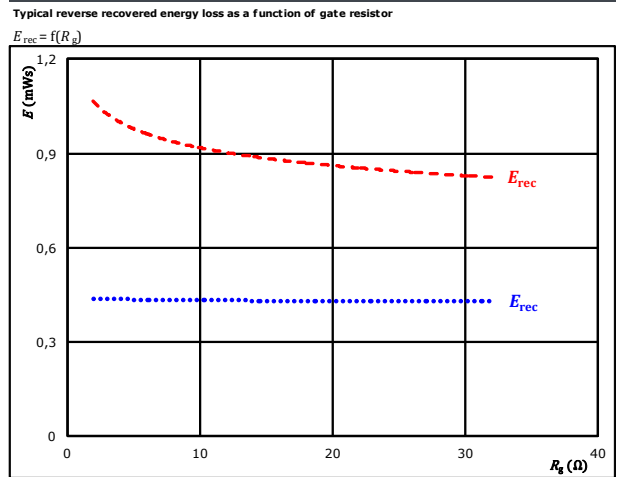
**figure 3.** FWD



With an inductive load at  
 $V_{CE} = 300$  V  
 $V_{GE} = \pm 15$  V  
 $R_{g\text{on}} = 8$   $\Omega$

$T_j$ : 25 °C (blue dotted), 150 °C (red dashed)

**figure 4.** FWD



With an inductive load at  
 $V_{CE} = 300$  V  
 $V_{GE} = \pm 15$  V  
 $I_C = 50$  A

$T_j$ : 25 °C (blue dotted), 150 °C (red dashed)



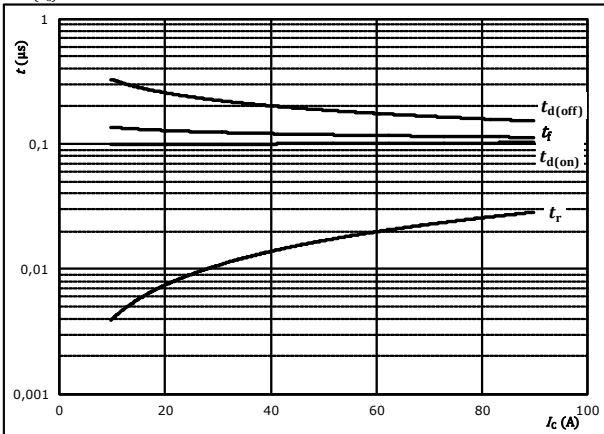


## Inverter Switching Characteristics

**figure 5.** IGBT

Typical switching times as a function of collector current

$$t = f(I_c)$$



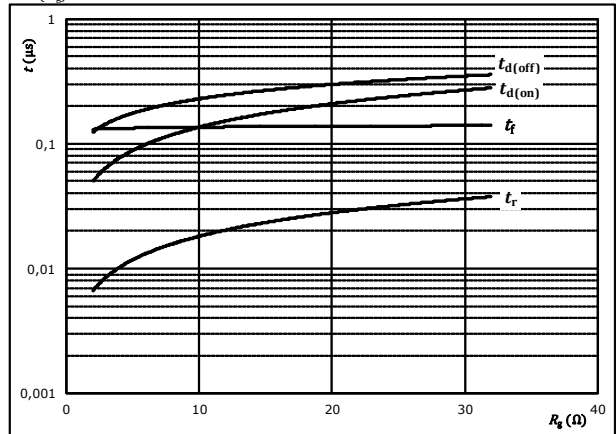
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	300	V
$V_{GE} =$	±15	V
$R_{g(on)} =$	8	Ω
$R_{g(off)} =$	8	Ω

**figure 6.** IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



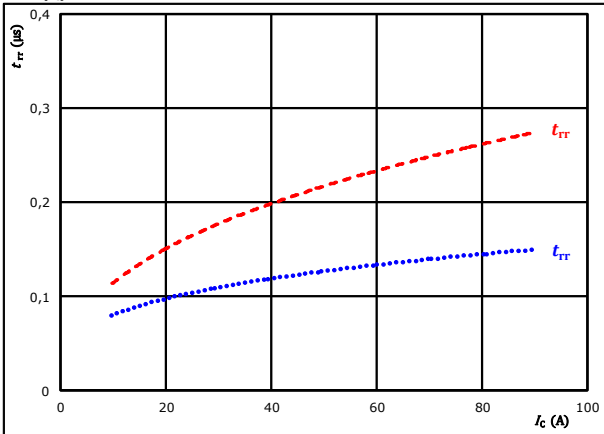
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	300	V
$V_{GE} =$	±15	V
$I_c =$	50	A

**figure 7.** FWD

Typical reverse recovery time as a function of collector current

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

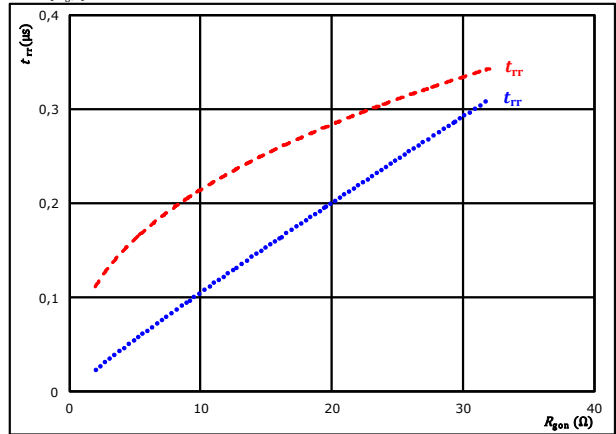


At	$V_{CE} =$	300	V	$T_j =$	25 °C	.....
	$V_{GE} =$	±15	V		150 °C	-----
	$R_{g(on)} =$	8	Ω			

**figure 8.** FWD

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

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



At	$V_{CE} =$	300	V	$T_j =$	25 °C	.....
	$V_{GE} =$	±15	V		150 °C	-----
	$I_c =$	50	A			

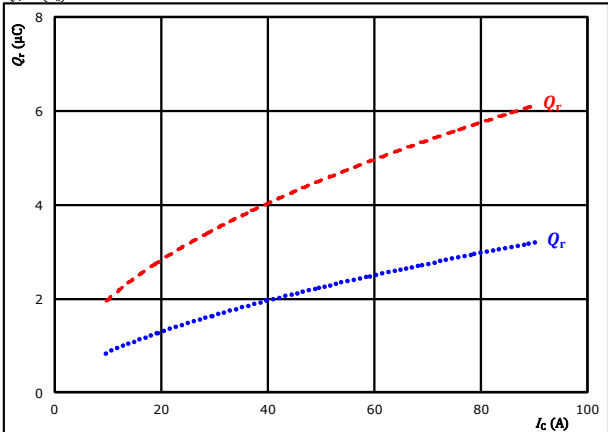


## Inverter Switching Characteristics

**figure 9.** FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

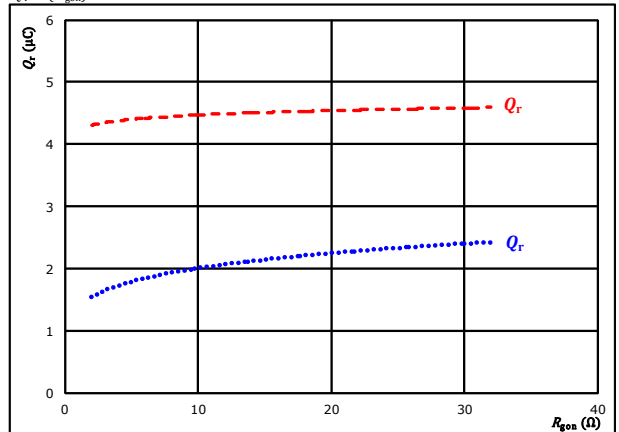


At  $V_{CE} = 300$  V  $T_j = 25^\circ\text{C}$  (blue dotted line)  
 $V_{GE} = \pm 15$  V  $T_j = 150^\circ\text{C}$  (red dashed line)  
 $R_{gdn} = 8 \Omega$

**figure 10.** FWD

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

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

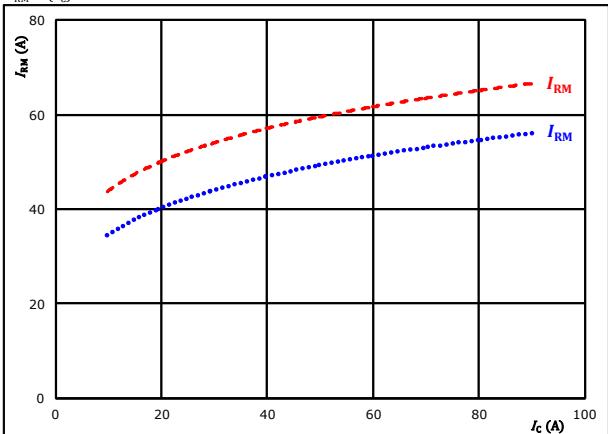


At  $V_{CE} = 300$  V  $T_j = 25^\circ\text{C}$  (blue dotted line)  
 $V_{GE} = \pm 15$  V  $T_j = 150^\circ\text{C}$  (red dashed line)  
 $I_c = 50$  A

**figure 11.** FWD

Typical peak reverse recovery current as a function of collector current

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

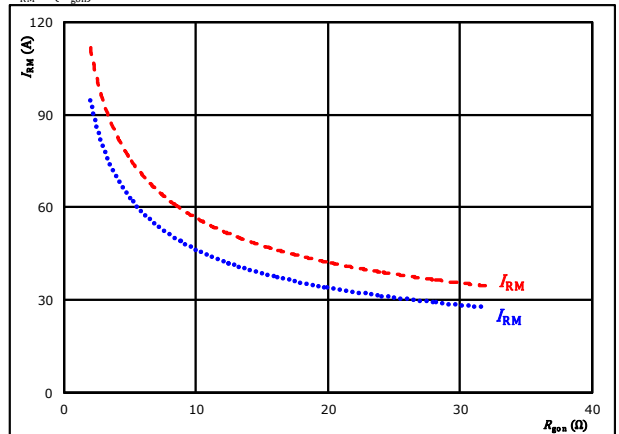


At  $V_{CE} = 300$  V  $T_j = 25^\circ\text{C}$  (blue dotted line)  
 $V_{GE} = \pm 15$  V  $T_j = 150^\circ\text{C}$  (red dashed line)  
 $R_{gdn} = 8 \Omega$

**figure 12.** FWD

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

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



At  $V_{CE} = 300$  V  $T_j = 25^\circ\text{C}$  (blue dotted line)  
 $V_{GE} = \pm 15$  V  $T_j = 150^\circ\text{C}$  (red dashed line)  
 $I_c = 50$  A



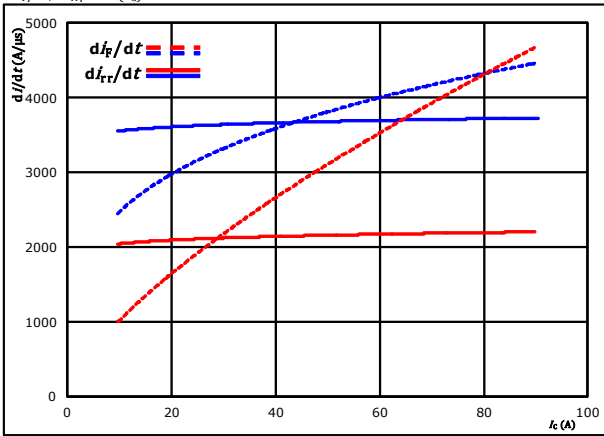
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## Inverter Switching Characteristics

**figure 13.** FWD

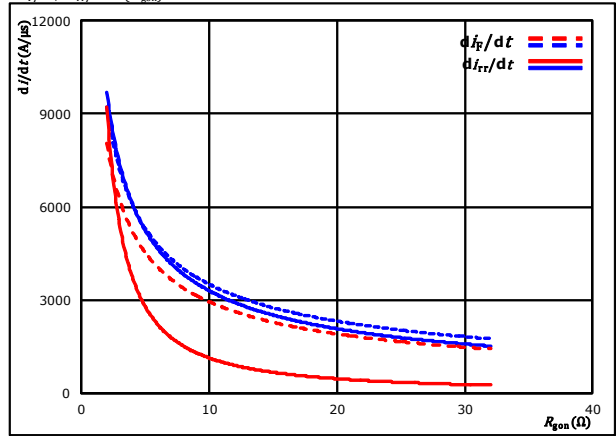
Typical rate of fall of forward and reverse recovery current as a function of collector current  
 $di_f/dt, di_{rr}/dt = f(I_c)$



At  $V_{CE} = 300$  V  $T_j = 25$  °C  
 $V_{GE} = \pm 15$  V  $150$  °C  
 $R_{g\text{on}} = 8$  Ω

**figure 14.** FWD

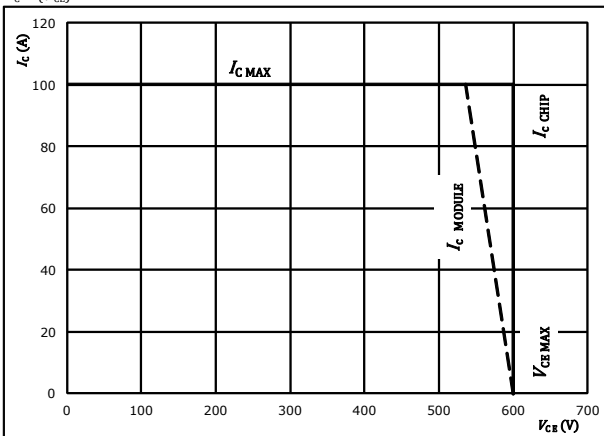
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor  
 $di_f/dt, di_{rr}/dt = f(R_{g\text{on}})$



At  $V_{CE} = 300$  V  $T_j = 25$  °C  
 $V_{GE} = \pm 15$  V  $150$  °C  
 $I_c = 50$  A

**figure 15.** IGBT

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



At  $T_j = 150$  °C  
 $R_{g\text{on}} = 8$  Ω  
 $R_{g\text{off}} = 8$  Ω

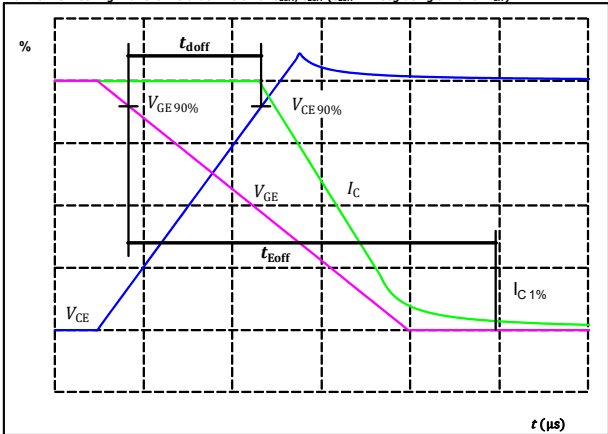


## Inverter Switching Definitions

General conditions		
$T_j$	=	125 °C
$R_{gon}$	=	8 $\Omega$
$R_{goff}$	=	8 $\Omega$

**figure 1.** IGBT

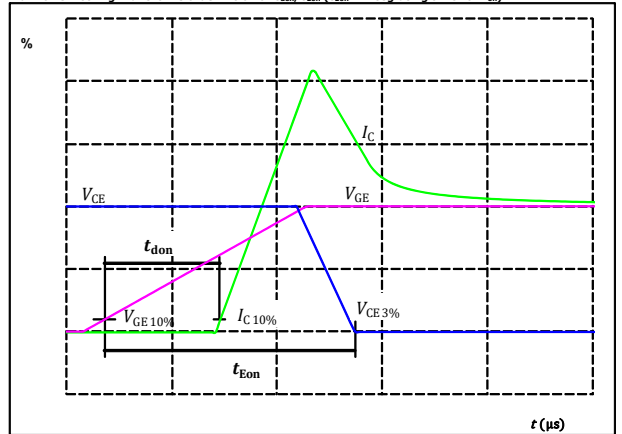
Turn-off Switching Waveforms & definition of  $t_{doff}$ ,  $t_{Eoff}$  ( $t_{Eoff}$  = integrating time for  $E_{off}$ )



$V_{CE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	300	V
$I_C(100\%) =$	50	A
$t_{doff} =$	184	ns

**figure 2.** IGBT

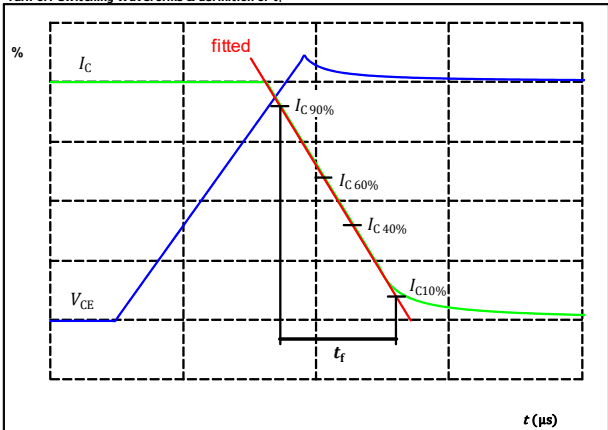
Turn-on Switching Waveforms & definition of  $t_{don}$ ,  $t_{Eon}$  ( $t_{Eon}$  = integrating time for  $E_{on}$ )



$V_{CE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	300	V
$I_C(100\%) =$	50	A
$t_{don} =$	100	ns

**figure 3.** IGBT

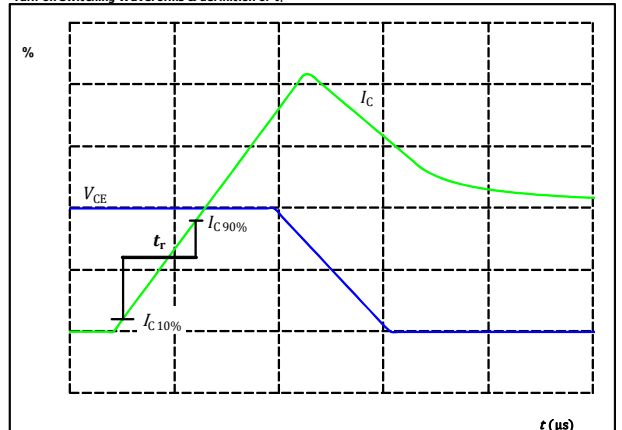
Turn-off Switching Waveforms & definition of  $t_f$



$V_C(100\%) =$	300	V
$I_C(100\%) =$	50	A
$t_f =$	131	ns

**figure 4.** IGBT

Turn-on Switching Waveforms & definition of  $t_r$



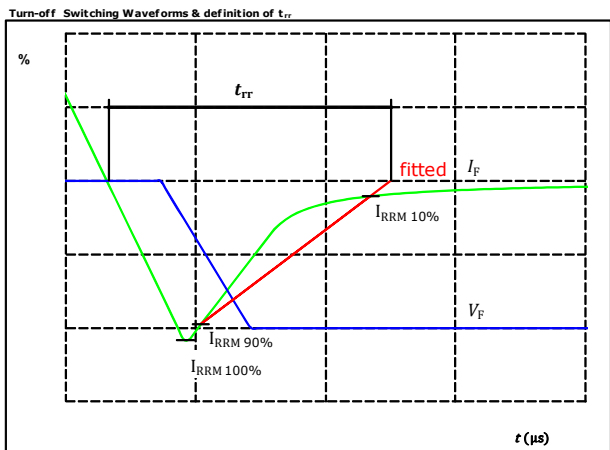
$V_C(100\%) =$	300	V
$I_C(100\%) =$	50	A
$t_r =$	18	ns



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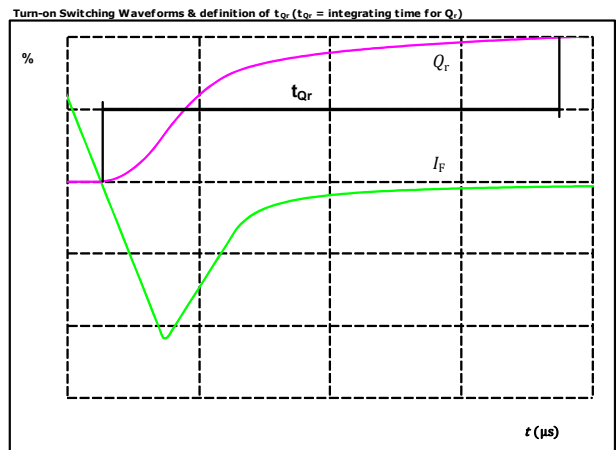
## Inverter Switching Characteristics

**figure 5.** FWD



$V_F(100\%) =$	300	V
$I_F(100\%) =$	50	A
$I_{RRM}(100\%) =$	62	A
$t_{rr} =$	172	ns

**figure 6.** FWD



$I_F(100\%) =$	50	A
$Q_r(100\%) =$	4,37	$\mu C$



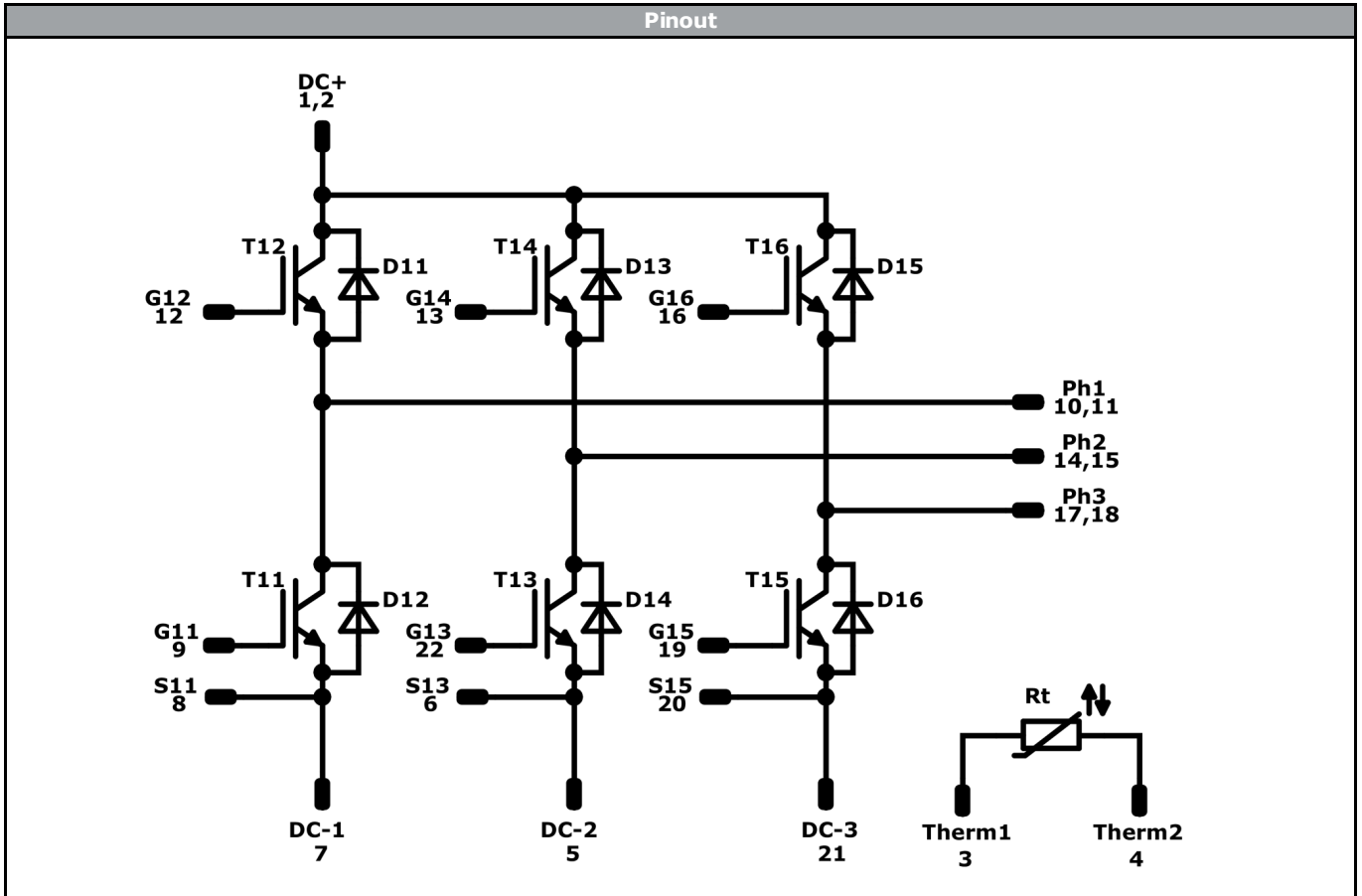
Ordering Code & Marking							
Version			Ordering Code				
without thermal paste 12 mm housing with press-fit pins			10-EZ066PA050SA-L855F38T				
with thermal paste 12 mm housing with press-fit pins			10-EZ066PA050SA-L855F38T-/3/				
without thermal paste 12 mm housing with solder pins			10-E1066PA050SA-L855F38Z				
with thermal paste 12 mm housing with solder pins			10-E1066PA050SA-L855F38Z-/3/				
NN-NNNNNNNNNNNN TTTTIV WWYY UL VIN LLLL SSSS		Text	Name	Date code	UL & VIN	Lot	Serial
			NN-NNNNNNNNNNNN-TTTTIV WWYY UL VIN LLLL SSSS	WWYY	UL VIN	LLLLL	SSSS
Datamatrix		Text	Type&Ver	Lot number	Serial	Date code	
			TTTTTIV	LLLLL	SSSS	WWYY	

Pin table				Outline	
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		

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



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<b>Identification</b>					
<b>ID</b>	<b>Component</b>	<b>Voltage</b>	<b>Current</b>	<b>Function</b>	<b>Comment</b>
T11, T12, T13, T14, T15, T16	IGBT	600 V	50 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	600 V	50 A	Inverter Diode	
Rt	NTC			Thermistor	




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10-EZ066PA050SA-L855F38T  
10-E1066PA050SA-L855F38Z  
datasheet

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-Ex066PA050SA-L855F38x-D3-14	30 May. 2019	Correction of $I_c/I_f$ values Outline updated	1 14

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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.