



Vincotech

# 10-FZ071SA075SM02-L525L18

datasheet

flowSPFC 0

650 V / 75 A

## Features

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

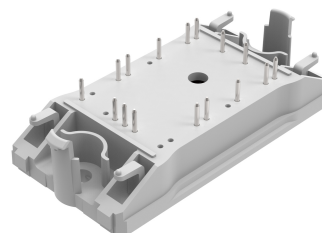
## Target applications

- Industrial Drives
- UPS

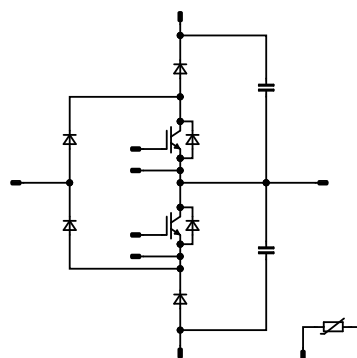
## Types

- 10-FZ071SA075SM02-L525L18

## flow 0 12 mm housing



## Schematic





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## Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
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### Boost Switch

Collector-emitter voltage	$V_{CES}$		650	V
Collector current (DC current)	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	57	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	225	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	97	W
Gate-emitter voltage	$V_{GES}$		$\pm 20$	V
Maximum junction temperature	$T_{jmax}$		175	°C

### Boost Diode

Peak repetitive reverse voltage	$V_{RRM}$		650	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	59	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	150	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	78	W
Maximum junction temperature	$T_{jmax}$		175	°C

### Boost Sw. Protection Diode

Peak repetitive reverse voltage	$V_{RRM}$		650	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	17	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	20	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	33	W
Maximum junction temperature	$T_{jmax}$		175	°C



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## Maximum Ratings

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

Parameter	Symbol	Conditions	Value	Unit
<b>Rectifier Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		1600	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	75	A
Surge (non-repetitive) forward current	$I_{FSM}$	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	490	A
Surge current capability	$I^2t$		1200	A <sup>2</sup> s
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	86	W
Maximum junction temperature	$T_{jmax}$		150	°C

## Capacitor (DC)

Maximum DC voltage	$V_{MAX}$		630	V
Operation Temperature	$T_{op}$		0 ... 125	°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* $t_p = 2\text{ s}$	6000	V
Isolation voltage	$V_{isol}$	AC Voltage $t_p = 1\text{ min}$	2500	V
Creepage distance			>12,7	mm
Clearance			9,15	mm
Comparative Tracking Index	CTI		≥ 200	

\*100 % tested in production



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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		

### Boost Switch

#### Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00075	25	3,3	4	4,7	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		75	25 125 150		1,67 1,84 1,89	2,22 <sup>(1)</sup>	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	$C_{ies}$	$f = 1 \text{ Mhz}$	0	25		25		4300		pF
Output capacitance	$C_{oes}$							75		pF
Reverse transfer capacitance	$C_{res}$							16		pF
Gate charge	$Q_g$	$V_{CC} = 520 \text{ V}$	15		75	25		166		nC

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						0,98		K/W
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#### Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 4 \Omega$ $R_{goff} = 4 \Omega$	-5/15	350	75	25 125 150		37 37,6 37,2		ns
Rise time	$t_r$					25 125 150		12,4 13,4 14,8		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		104 117,2 122,2		ns
Fall time	$t_f$					25 125 150		4,58 9,59 11,2		ns
Turn-on energy (per pulse)	$E_{on}$					25 125 150		0,913 1,4 1,55		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		0,406 0,635 0,685		mWs



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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	

### Boost Diode

#### Static

Forward voltage	$V_F$				75	25 125 150		1,53 1,49 1,46	1,92 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_i = 650$ V				25			3,8	µA

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,22		K/W
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#### Dynamic

Peak recovery current	$I_{RRM}$	$di/dt=7140$ A/µs $di/dt=5910$ A/µs $di/dt=6120$ A/µs	-5/15	350	75	25 125 150		68,37 90,82 96,61		A
Reverse recovery time	$t_{rr}$					25 125 150		66,09 97,99 111,75		ns
Recovered charge	$Q_r$					25 125 150		2,53 4,71 5,47		µC
Reverse recovered energy	$E_{rec}$					25 125 150		0,576 1,1 1,3		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125 150		913,97 1029 1047		A/µs



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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	

### Boost Sw. Protection Diode

#### Static

Forward voltage	$V_F$			10	25 125		1,23	1,67 1,56	1,87 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_r = 650$ V			25				0,14	μA

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						2,87		K/W
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### Rectifier Diode

#### Static

Forward voltage	$V_F$			25	25 125 150			0,987 0,898 0,875	1,21 <sup>(1)</sup> 1,1 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_r = 1600$ V			25				50	μA

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,82		K/W
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### Capacitor (DC)

#### Static

Capacitance	$C$	DC bias voltage = 0 V				25		150		nF
Tolerance							-10		10	%



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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 $R_{100}$	$\Delta_{R/R}$	$R_{100} = 1484 \Omega$				100	-5		5	%
Power dissipation	$P$							5		mW
Power dissipation constant	$d$					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. $\pm 1 \%$						3962		K
B-value	$B_{(25/100)}$	Tol. $\pm 1 \%$						4000		K
Vincotech Thermistor Reference									I	

<sup>(1)</sup> Value at chip level

<sup>(2)</sup> Only valid with pre-applied Vincotech thermal interface material.



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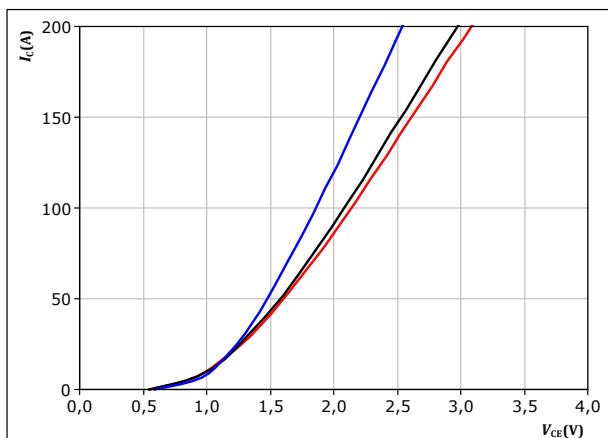
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## Boost Switch Characteristics

figure 1. IGBT

Typical output characteristics

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

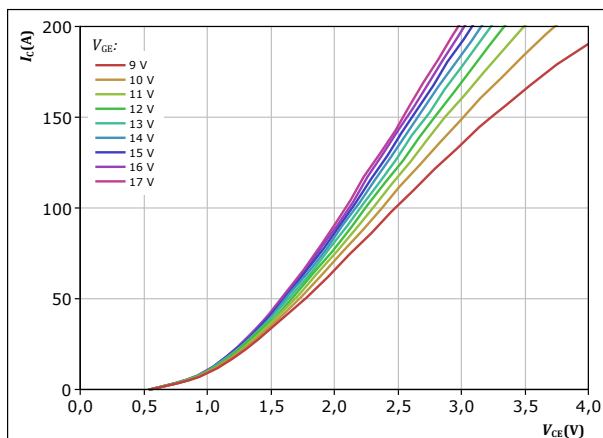


$t_p = 250 \mu s$   
 $V_{GE} = 15 V$   
 $T_j: 25 \text{ } ^\circ C$   
 $125 \text{ } ^\circ C$   
 $150 \text{ } ^\circ C$

figure 2. IGBT

Typical output characteristics

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

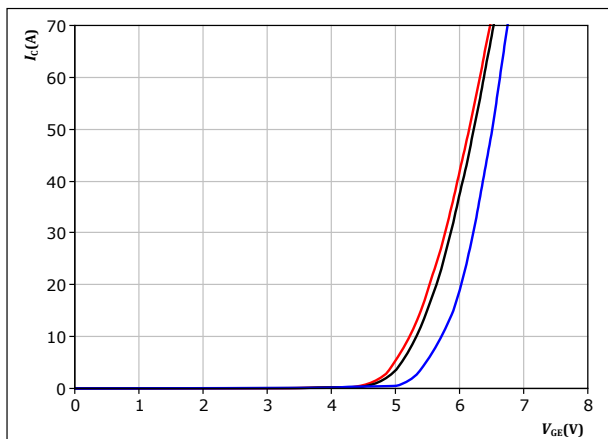


$t_p = 250 \mu s$   
 $T_j = 150 \text{ } ^\circ C$   
 $V_{GE}$  from 9 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

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

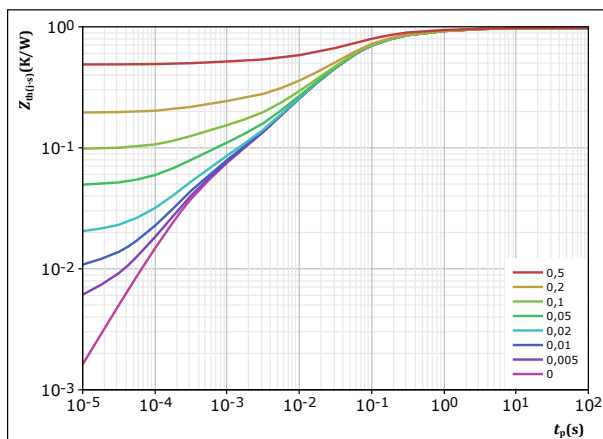


$t_p = 250 \mu s$   
 $V_{CE} = 10 V$   
 $T_j: 25 \text{ } ^\circ C$   
 $125 \text{ } ^\circ C$   
 $150 \text{ } ^\circ C$

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,976 K/W$   
 IGBT thermal model values  

$R (K/W)$	$\tau (s)$
7,21E-02	2,25E+00
1,46E-01	3,32E-01
4,74E-01	6,42E-02
1,76E-01	1,63E-02
6,17E-02	3,99E-03
4,63E-02	3,57E-04





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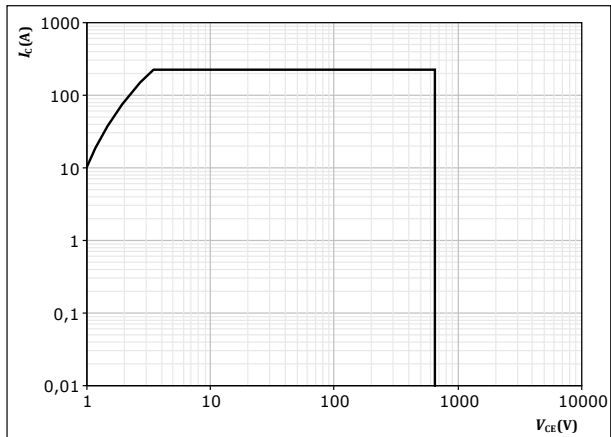
## Boost Switch Characteristics

figure 5.

IGBT

Safe operating area

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



$D = \text{single pulse}$

$T_s = 80 \text{ } ^\circ\text{C}$   
 $V_{GE} = 15 \text{ V}$   
 $T_j = T_{jmax}$



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## Boost Diode Characteristics

figure 6. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

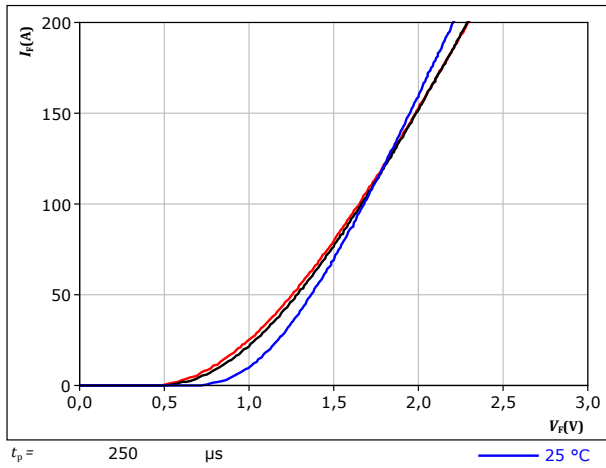
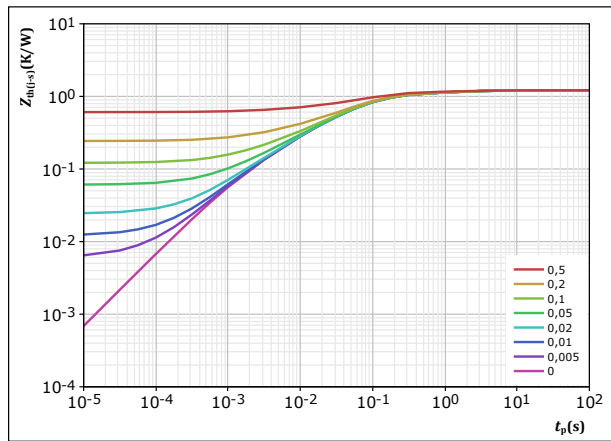


figure 7. FWD

Transient thermal impedance as a function of pulse width

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



$D =$	$t_p / T$	
$R_{th(j-s)} =$	1,215	K/W
FWD thermal model values		
$R$ (K/W)	$\tau$ (s)	
5,70E-02	4,14E+00	
1,13E-01	8,84E-01	
4,50E-01	1,20E-01	
4,13E-01	3,77E-02	
1,42E-01	7,04E-03	
4,07E-02	1,20E-03	



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## Boost Sw. Protection Diode Characteristics

figure 8. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

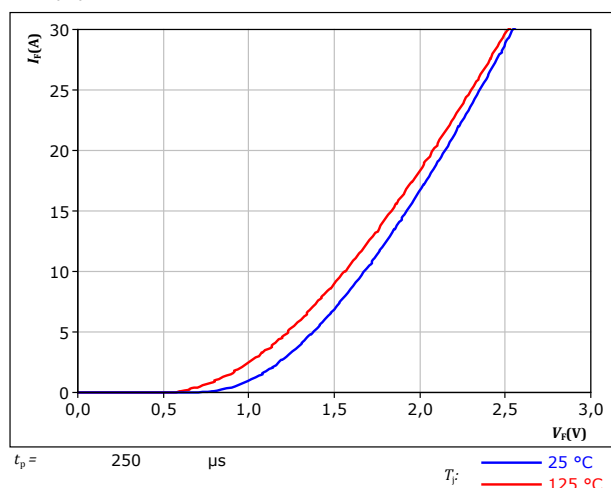
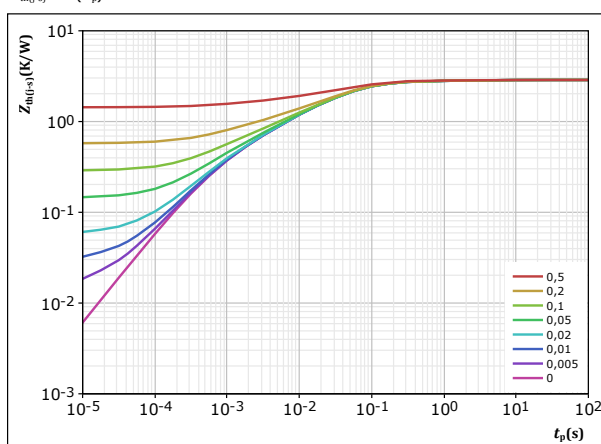


figure 9. FWD

Transient thermal impedance as a function of pulse width

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



$D =$	$t_p / T$	
$R_{th(j-s)} =$	2,873	K/W
FWD thermal model values		
$R$ (K/W)	$\tau$ (s)	
6,53E-02	3,94E+00	
1,48E-01	4,48E-01	
1,31E+00	5,96E-02	
7,32E-01	1,36E-02	
4,04E-01	2,79E-03	
2,11E-01	5,37E-04	



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## Rectifier Diode Characteristics

figure 10.

Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

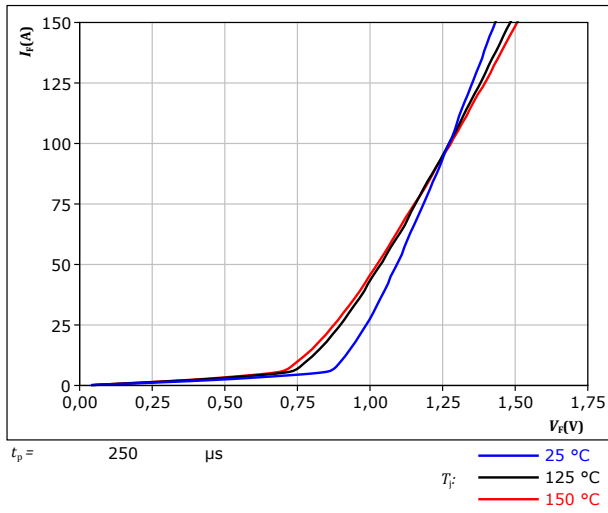
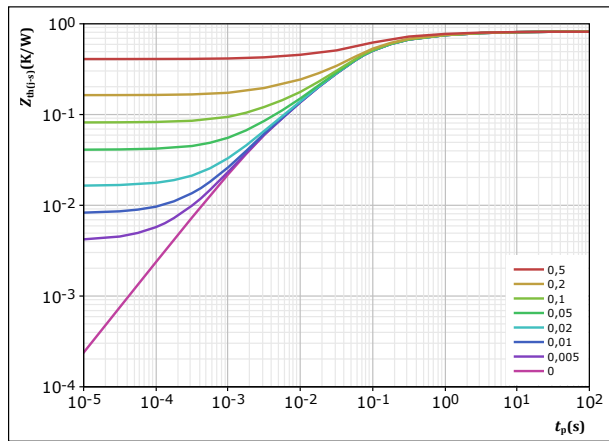


figure 11.

Rectifier

Transient thermal impedance as a function of pulse width

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



$D =$	$t_p / T$
$R_{th(j-s)} =$	0,818 K/W
Rectifier thermal model values	
$R$ (K/W)	$\tau$ (s)
3,88E-02	6,63E+00
1,02E-01	9,24E-01
2,75E-01	1,59E-01
3,47E-01	4,48E-02
4,81E-02	3,54E-03
6,71E-03	1,09E-02



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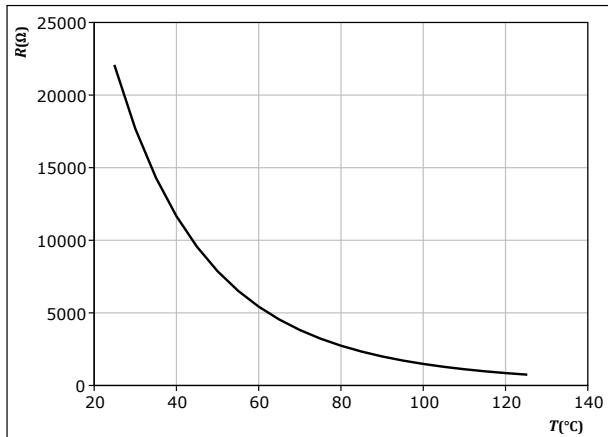
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datasheet

## Thermistor Characteristics

**figure 12.** Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$





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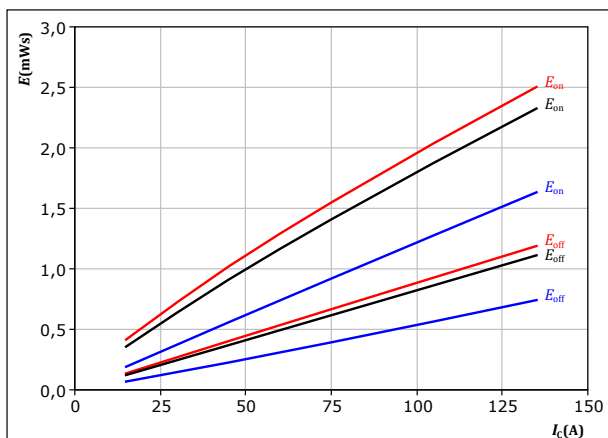
## Boost Switching Characteristics

figure 13.

IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_C)$$



With an inductive load at

$V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5/15 \text{ V}$   
 $R_{gon} = 4 \text{ } \Omega$   
 $R_{goff} = 4 \text{ } \Omega$

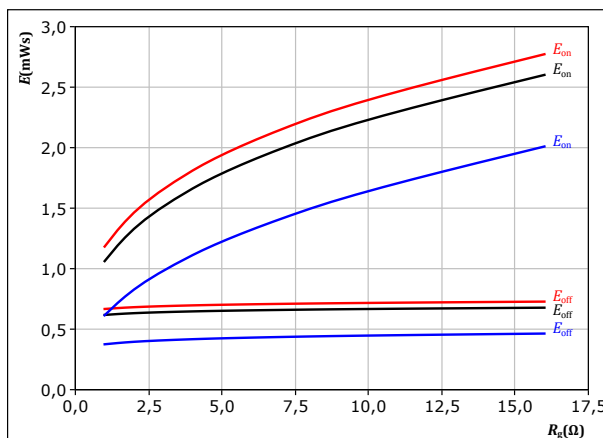
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 14.

IGBT

Typical switching energy losses as a function of gate resistor

$$E = f(R_g)$$



With an inductive load at

$V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5/15 \text{ V}$   
 $I_C = 75 \text{ A}$

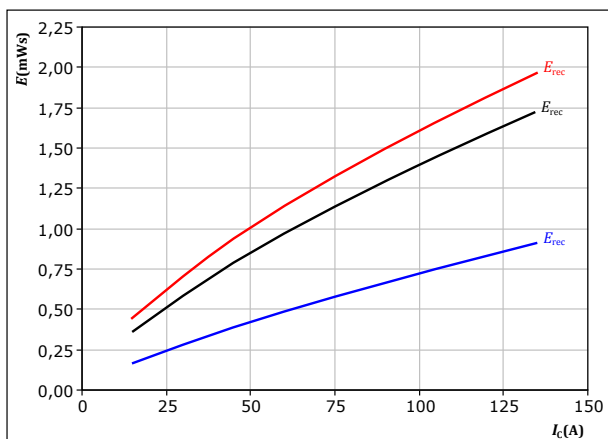
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 15.

FWD

Typical reverse recovered energy loss as a function of collector current

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



With an inductive load at

$V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5/15 \text{ V}$   
 $R_{gon} = 4 \text{ } \Omega$

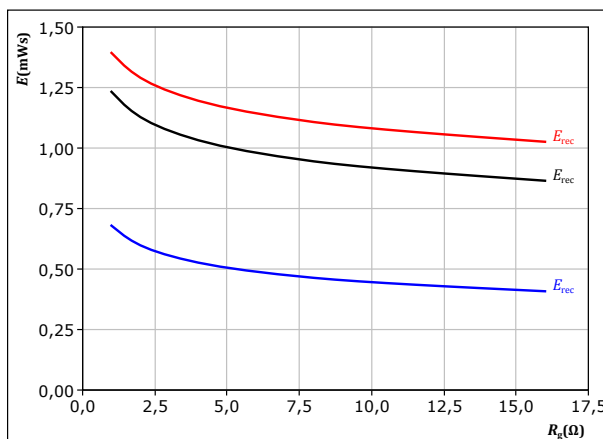
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 16.

FWD

Typical reverse recovered energy loss as a function of gate resistor

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



With an inductive load at

$V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5/15 \text{ V}$   
 $I_C = 75 \text{ A}$

$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C



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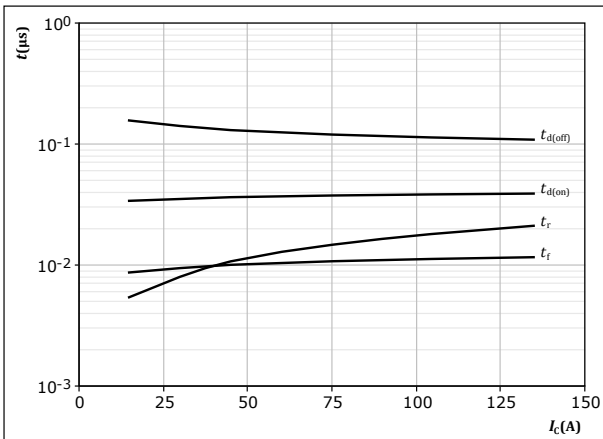
datasheet

## Boost Switching Characteristics

figure 17.

IGBT

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



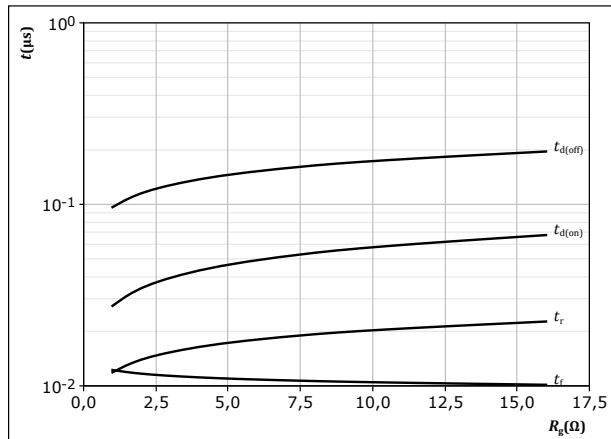
With an inductive load at

$T_j = 150 \text{ } ^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5/15 \text{ V}$   
 $R_{gon} = 4 \text{ } \Omega$   
 $R_{goff} = 4 \text{ } \Omega$

figure 18.

IGBT

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



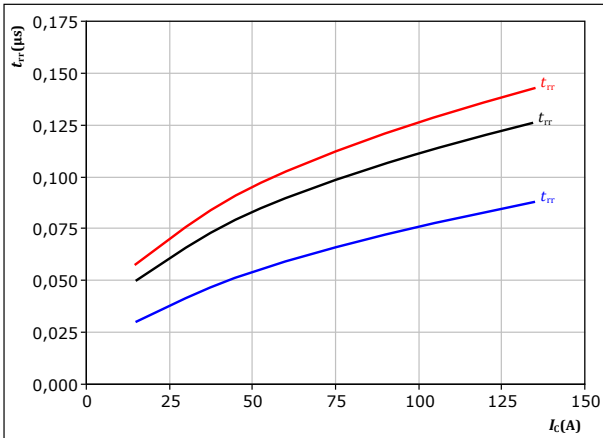
With an inductive load at

$T_j = 150 \text{ } ^\circ\text{C}$   
 $V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5/15 \text{ V}$   
 $I_c = 75 \text{ A}$

figure 19.

FWD

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



With an inductive load at

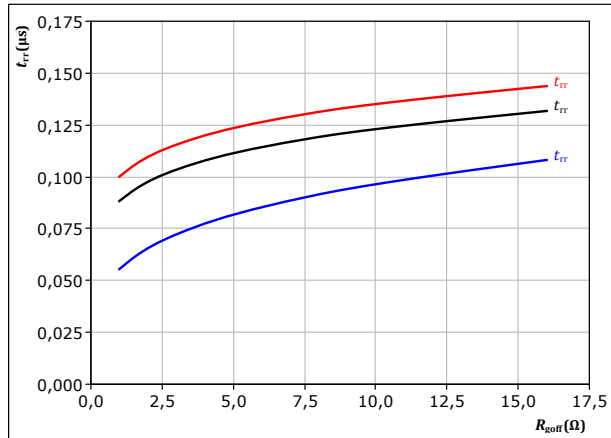
$V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5/15 \text{ V}$   
 $R_{gon} = 4 \text{ } \Omega$

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

figure 20.

FWD

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



With an inductive load at

$V_{CE} = 350 \text{ V}$   
 $V_{GE} = -5/15 \text{ V}$   
 $I_c = 75 \text{ A}$

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C



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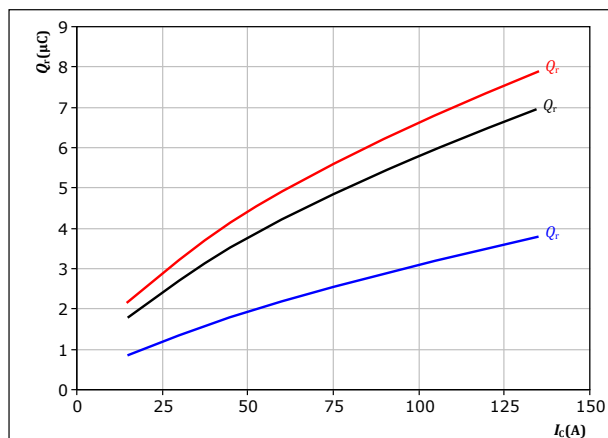
## Boost Switching Characteristics

figure 21.

FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_C)$$



With an inductive load at

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

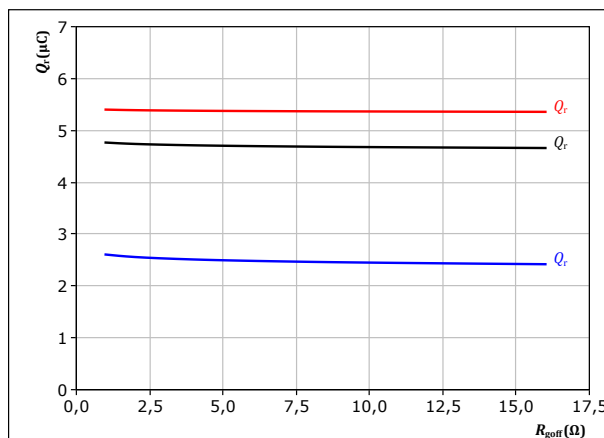
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 22.

FWD

Typical recovered charge as a function of turn off gate resistor

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



With an inductive load at

$V_{CE} = 350$  V  
 $V_{GE} = -5/15$  V  
 $I_C = 75$  A

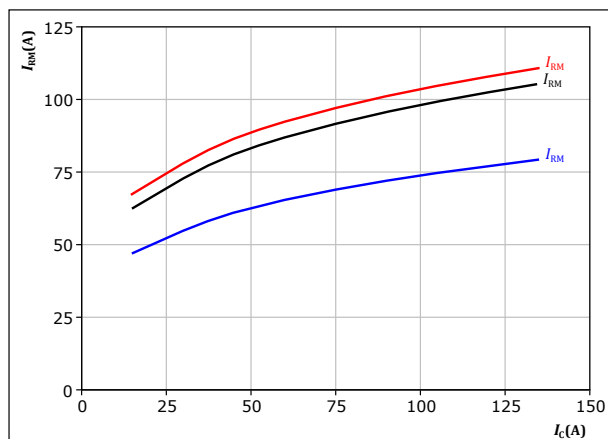
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 23.

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

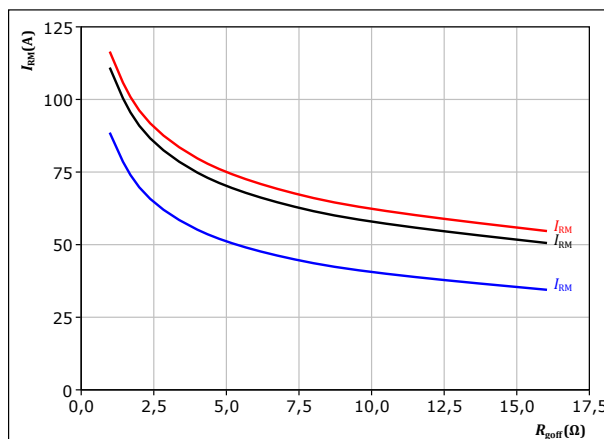
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 24.

FWD

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

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



With an inductive load at

$V_{CE} = 350$  V  
 $V_{GE} = -5/15$  V  
 $I_C = 75$  A

$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C





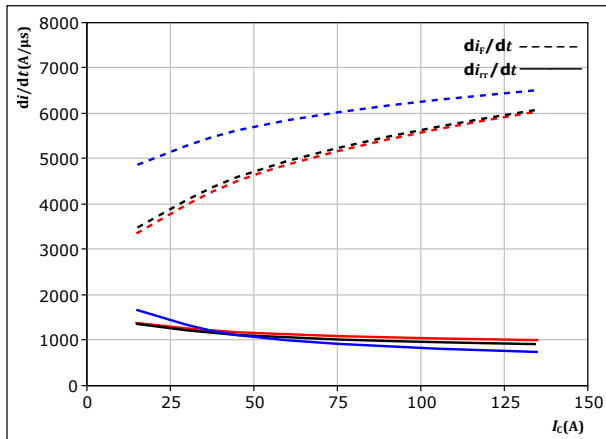
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## Boost Switching Characteristics

figure 25. 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

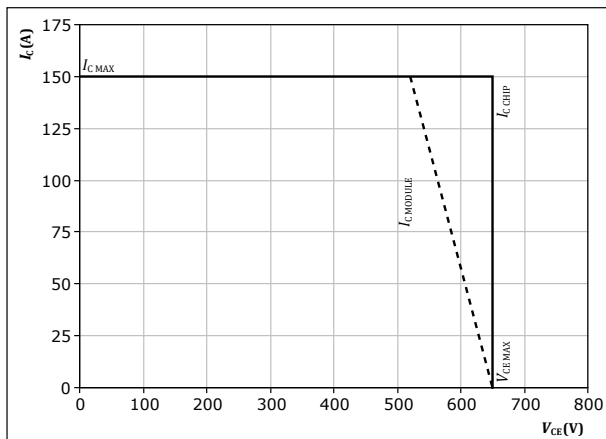
$V_{CE} = 350$  V  
 $V_{GE} = -5/15$  V  
 $R_{goff} = 4$   $\Omega$

$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 26. FWD

Reverse bias safe operating area

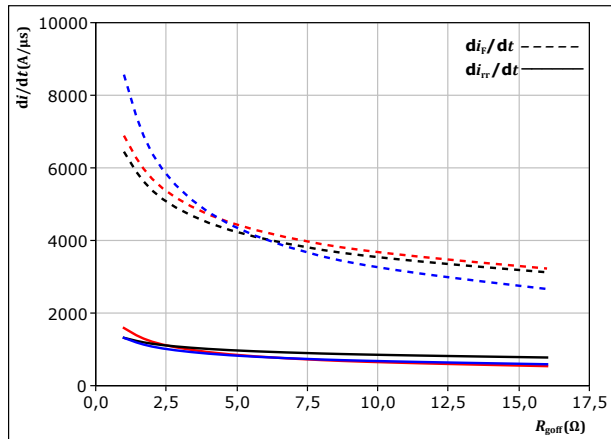
$I_C = f(V_{CE})$



At  $T_j = 150$  °C  
 $R_{goff} = 4$   $\Omega$   
 $R_{goff} = 4$   $\Omega$

figure 26. FWD

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



With an inductive load at

$V_{CE} = 350$  V  
 $V_{GE} = -5/15$  V  
 $I_C = 75$  A

$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C



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## Boost Switching Definitions

figure 28. IGBT

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

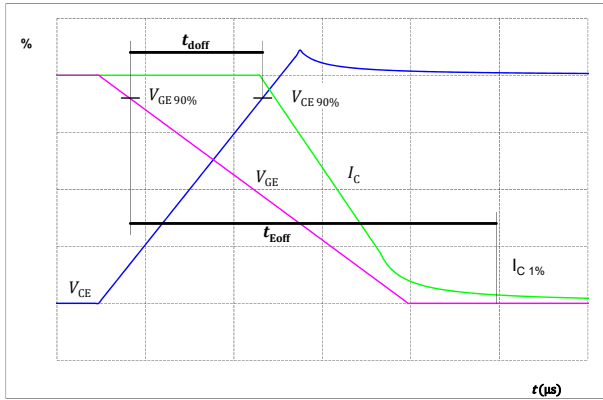


figure 29. IGBT

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

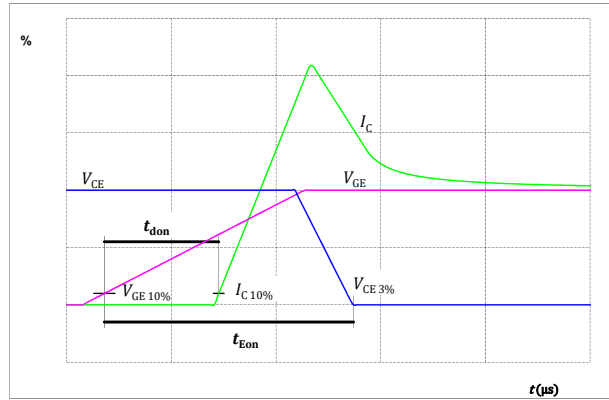


figure 30. IGBT

Turn-off Switching Waveforms & definition of  $t_f$

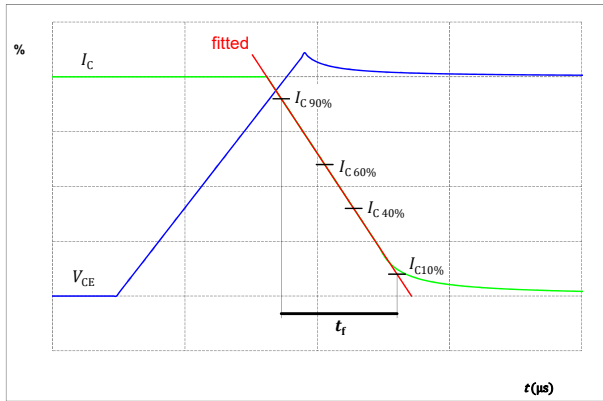
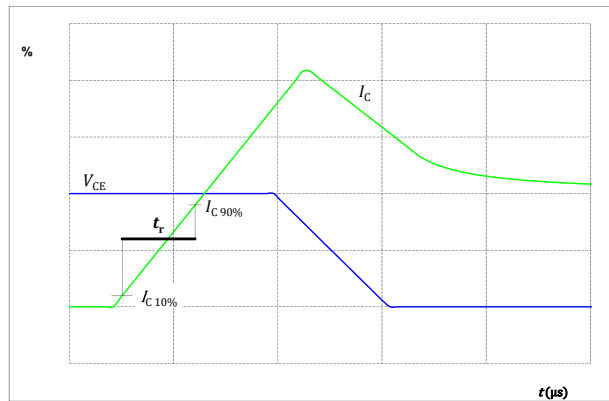


figure 31. IGBT

Turn-on Switching Waveforms & definition of  $t_r$





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## Boost Switching Definitions

figure 32.

FWD

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

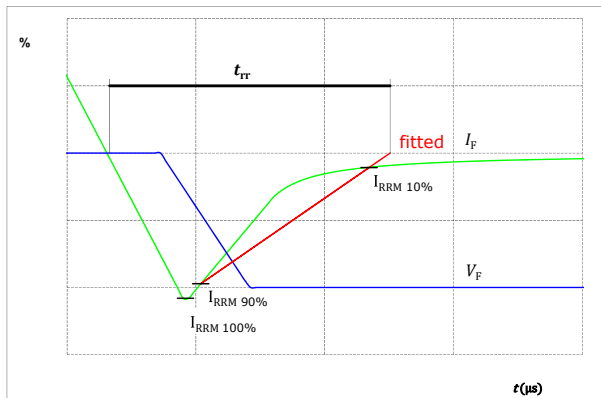
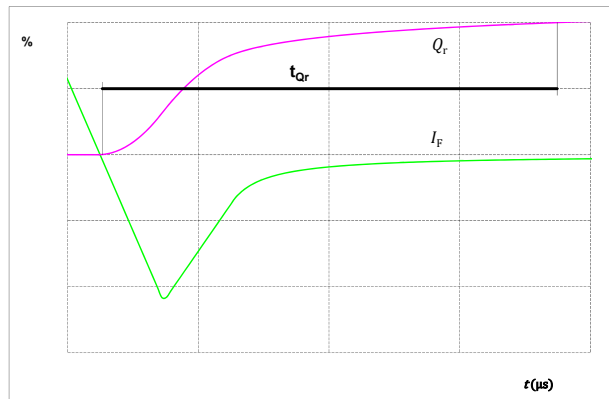


figure 33.

FWD

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





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Ordering Code	
Version	Ordering Code
Without thermal paste	10-FZ071SA075SM02-L525L18
With thermal paste (5,2 W/mK, PTM6000HV)	10-FZ071SA075SM02-L525L18-/7/
With thermal paste (3,4 W/mK, PSX-P7)	10-FZ071SA075SM02-L525L18-/3/

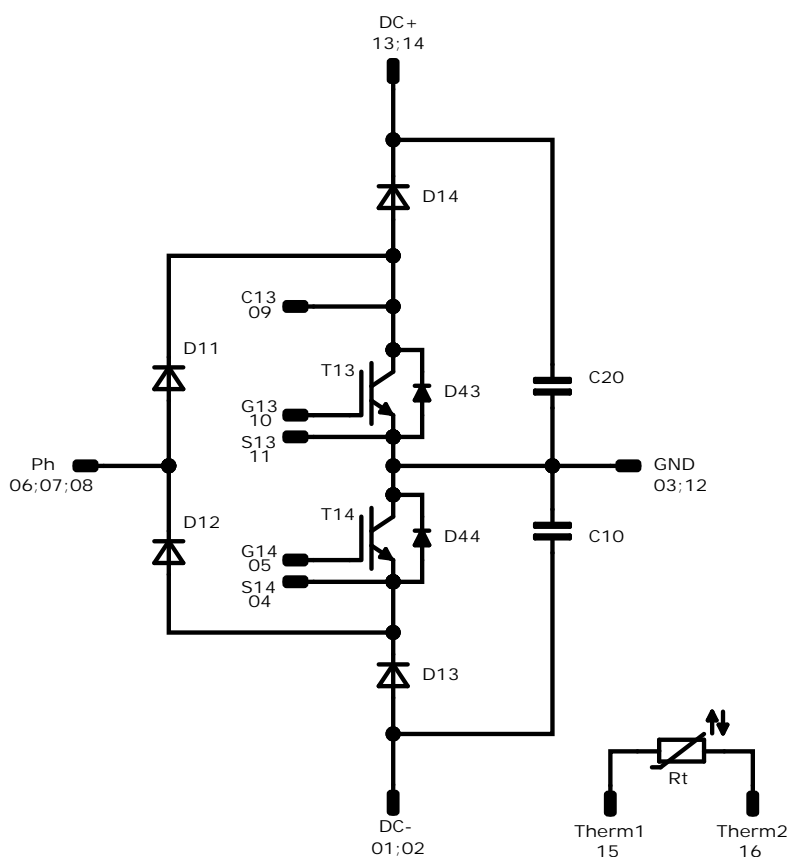
Marking						
Text	Name		Date code	UL & VIN	Lot	Serial
	NN-NNNNNNNNNNNNNN- TTTTTVV		WWYY	UL VIN	LLLLL	SSSS
Datamatrix	Type&Ver	Lot number	Serial	Date code		
	TTTTTVV	LLLLL	SSSS	WWYY		

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
T14, T13	IGBT	650 V	75 A	Boost Switch	
D13, D14	FWD	650 V	75 A	Boost Diode	
D44, D43	FWD	650 V	10 A	Boost Sw. Protection Diode	
D11, D12	Rectifier	1600 V	50 A	Rectifier Diode	
C10, C20	Capacitor	630 V		Capacitor (DC)	
Rt	Thermistor			Thermistor	



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**10-FZ071SA075SM02-L525L18**  
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Packaging instruction				
Standard packaging quantity (SPQ) 135	>SPQ	Standard	<SPQ	Sample
Handling instruction				
Handling instructions for <i>flow 0</i> packages see vincotech.com website.				
Package data				
Package data for <i>flow 0</i> 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-FZ071SA075SM02-L525L18-D2-14	20 Sep. 2021	New Datasheet format, module is unchanged Add dynamic values to characteristic tables	

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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.