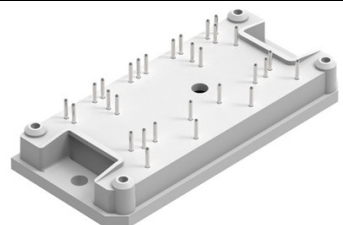
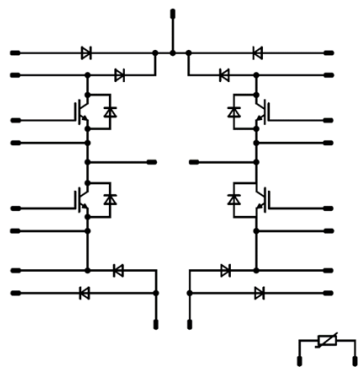




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<i>flowBOOST 1 symmetric dual</i>	<b>1200 V / 75 A</b>
<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; margin: 0;"><b>Features</b></p> <ul style="list-style-type: none"> <li>Symmetric Boost for 1500Vdc applications</li> <li>Latest IGBT technology for high speed frequencies</li> <li>Low inductance package</li> <li>Integrated NTC</li> <li>Cost effective alternative to L869L08</li> <li>Same package and pin-out as L869L08</li> </ul> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; margin: 0;"><b>Target applications</b></p> <ul style="list-style-type: none"> <li>Solar Inverters</li> </ul> </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; margin: 0;"><b>Types</b></p> <ul style="list-style-type: none"> <li>10-FY12S2A075SH-L860L48</li> </ul> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; margin: 0;"><i>flow 1 12 mm housing</i></p>  </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; margin: 0;"><b>Schematic</b></p>  </div>

## Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
<b>Boost Switch</b>				
Collector-emitter voltage	$V_{CES}$		1200	V
Collector current	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ }^\circ\text{C}$	60	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	225	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ }^\circ\text{C}$	141	W
Gate-emitter voltage	$V_{GES}$		$\pm 20$	V
Short circuit ratings	$t_{SC}$	$V_{GE} = 15\text{ V}$ $V_{CE} = 800\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$	10	$\mu\text{s}$
Maximum junction temperature	$T_{jmax}$		175	$^\circ\text{C}$



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## Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
<b>Boost Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		1200	V
Continuous (direct) forward current	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	28	A
Repetitive peak forward current	$I_{FRM}$		92	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	87	W
Maximum junction temperature	$T_{jmax}$		175	°C
<b>Boost Sw. Protection Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		1600	V
Continuous (direct) forward current	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	25	A
Surge (non-repetitive) forward current	$I_{FSM}$	50 Hz Single Half Sine Wave $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	200	A
Surge current capability	$I^2t$		200	A <sup>2</sup> s
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	37	W
Maximum junction temperature	$T_{jmax}$		150	°C
<b>ByPass Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		1600	V
Continuous (direct) forward current	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	38	A
Surge (non-repetitive) forward current	$I_{FSM}$	50 Hz Single Half Sine Wave $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	270	A
Surge current capability	$I^2t$		370	A <sup>2</sup> s
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	47	W
Maximum junction temperature	$T_{jmax}$		150	°C



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## Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
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### Module Properties

#### Thermal Properties

Storage temperature	$T_{stg}$		-40...+125	°C
Operation temperature under switching condition	$T_{top}$		-40...(T <sub>max</sub> - 25)	°C

#### Isolation Properties

Isolation voltage	$V_{isol}$	DC Test Voltage* $t_p = 2\text{ s}$	6000	V
Creepage distance			min. 12,7	mm
Clearance			9,6	mm
Comparative Tracking Index	CTI		> 200	

\*100 % tested in production



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## Characteristic Values

Parameter	Symbol	Conditions					Value			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	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0026	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	$V_{CEsat}$		15		75	25 125 150	1,78	2,16 2,48 2,56	2,42	V
Collector-emitter cut-off current	$I_{CES}$		0	1200		25			1	μA
Gate-emitter leakage current	$I_{GES}$		20	0		25			120	nA
Internal gate resistance	$r_g$							none		Ω
Input capacitance	$C_{ies}$	$f = 1$ Mhz	0	25		25		4400		pF
Reverse transfer capacitance	$C_{res}$							235		

#### Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,68		K/W
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#### Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 4$ Ω $R_{goff} = 4$ Ω	0 / 15	700	45	25		16		ns
Rise time	$t_r$					125		15		
Turn-off delay time	$t_{d(off)}$					150		14		
Fall time	$t_f$					25		235		
Turn-on energy (per pulse)	$E_{on}$					125		309		
Turn-off energy (per pulse)	$E_{off}$					150		326		
						25		20		
		125		56						
		150		72						
		25		1,062						
		125		1,154						
		150		1,213						
		25		1,859						
		125		3,343						
		150		3,725						



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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		

#### Boost Diode

##### Static

Parameter	Symbol	$V_{GE}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Forward voltage	$V_F$			20	25 125 150		1,43 1,74 1,85	1,6	V
Reverse leakage current	$I_R$		1200		25 150			400	$\mu$ A

##### Thermal

Parameter	Symbol	Conditions	Value	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)	1,09	K/W

##### Dynamic

Parameter	Symbol	$V_{GE}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Peak recovery current	$I_{RRM}$				25 125 150		17 19 20		A
Reverse recovery time	$t_{rr}$				25 125 150		10 10 11		ns
Recovered charge	$Q_r$	$di/dt = 3340$ A/ $\mu$ s $di/dt = 3517$ A/ $\mu$ s $di/dt = 3726$ A/ $\mu$ s	0 / 15	700	45	25 125 150	0,383 0,491 0,434		$\mu$ C
Reverse recovered energy	$E_{rec}$				25 125 150		0,176 0,237 0,199		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$				25 125 150		5147 5555 6124		A/ $\mu$ s

#### Boost Sw. Protection Diode

##### Static

Parameter	Symbol	$V_{GE}$ [V]	$V_{CE}$ [V]	$I_C$ [A]	$T_j$ [°C]	Min	Typ	Max	Unit
Forward voltage	$V_F$			18	25 125		1,12 1,03	1,5	V
Reverse leakage current	$I_R$		1600		25 150			100 1000	$\mu$ A

##### Thermal

Parameter	Symbol	Conditions	Value	Unit
Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)	1,87	K/W



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## Characteristic Values

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

### ByPass Diode

#### Static

Forward voltage	$V_F$				28	25 125		1,15 1,10	1,5	V
Reverse leakage current	$I_R$			1600		25 150			100 1000	$\mu$ A

#### Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,50		K/W
-------------------------------------	---------------	---------------------------------------	--	--	--	--	--	------	--	-----

### Thermistor

Rated resistance	$R$					25		22		k $\Omega$
Deviation of $R_{100}$	$\Delta_{R/R}$	$R_{100} = 1484$ $\Omega$				100	-5		5	%
Power dissipation	$P$					25		5		mW
Power dissipation constant						25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. $\pm 1$ %				25		3962		K
B-value	$B_{(25/100)}$	Tol. $\pm 1$ %				25		4000		K
Vincotech NTC Reference									I	

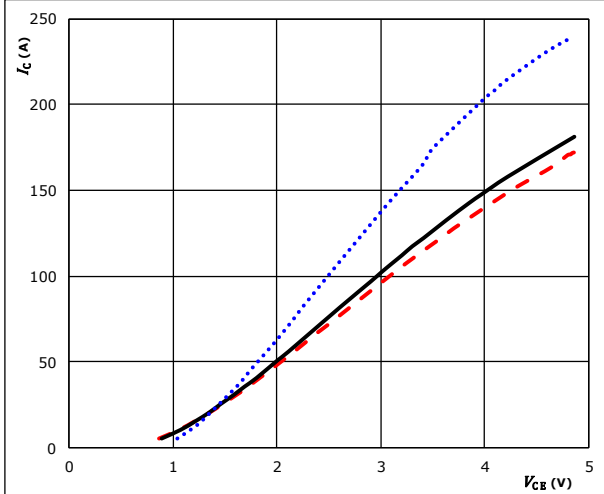


### Boost Switch Characteristics

**figure 1.** IGBT

Typical output characteristics

$I_C = f(V_{CE})$

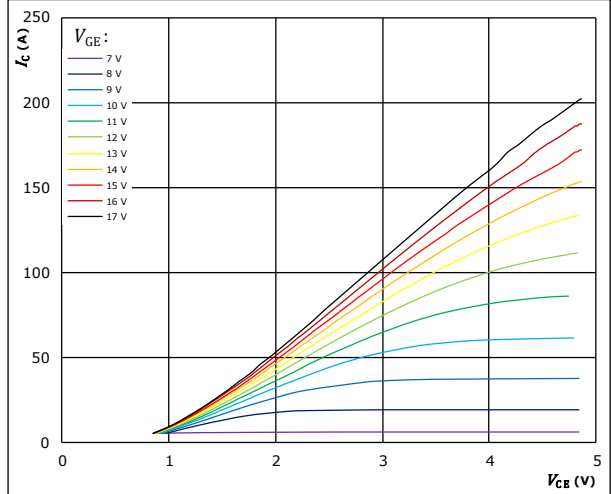


$t_p = 250 \mu s$        $T_j: 25 \text{ }^\circ C$       .....  
 $V_{GE} = 15 \text{ V}$        $T_j: 125 \text{ }^\circ C$       ———  
                           $T_j: 150 \text{ }^\circ C$       - - - -

**figure 2.** IGBT

Typical output characteristics

$I_C = f(V_{CE})$

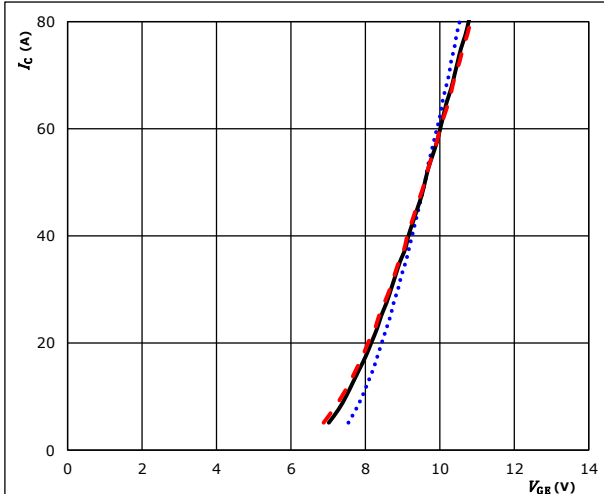


$t_p = 250 \mu s$        $T_j = 125 \text{ }^\circ C$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

**figure 3.** IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

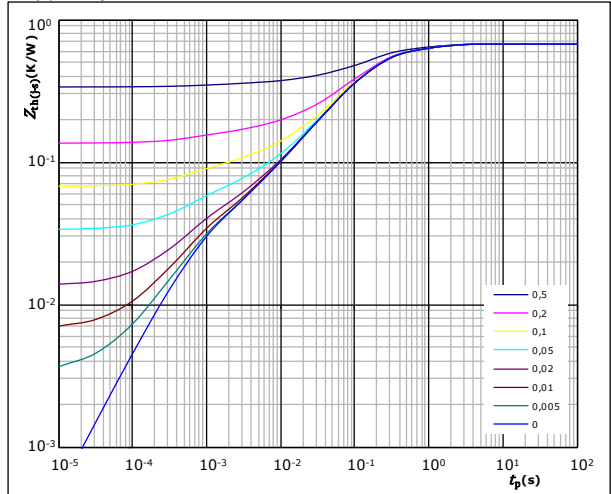


$t_p = 100 \mu s$        $T_j: 25 \text{ }^\circ C$       .....  
 $V_{CE} = 0 \text{ V}$        $T_j: 125 \text{ }^\circ C$       ———  
                           $T_j: 150 \text{ }^\circ C$       - - - -

**figure 4.** IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,68 \text{ K/W}$

IGBT thermal model values

R (K/W)	$\tau$ (s)
1,22E-01	9,38E-01
3,87E-01	1,40E-01
9,92E-02	4,82E-02
3,95E-02	8,51E-03
2,86E-02	7,35E-04



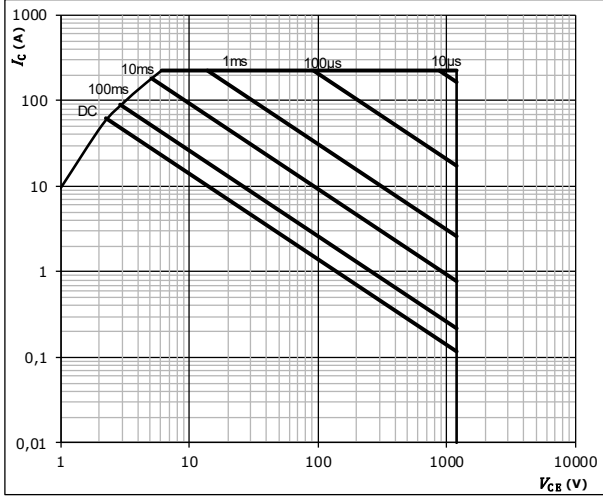
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### Boost Switch Characteristics

figure 5. IGBT

Safe operating area

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



- $D =$  single pulse
- $T_s =$  80 °C
- $V_{GE} =$  0 V
- $T_j =$   $T_{jmax}$



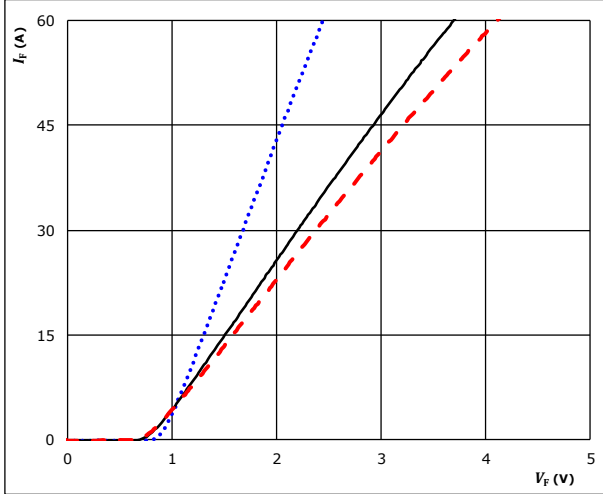


### Boost Diode Characteristics

**figure 1.** FWD

Typical forward characteristics

$$I_F = f(V_F)$$

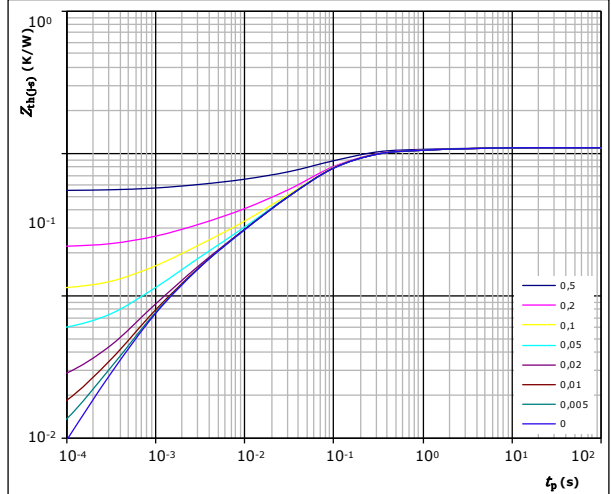


$t_p = 250 \mu s$   
 $T_j$ : 25 °C .....  
 125 °C ———  
 150 °C - - - -

**figure 2.** FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 1,09 \text{ K/W}$   
 FWD thermal model values

$R$ (K/W)	$\tau$ (s)
4,73E-02	2,07E+00
1,05E-01	2,95E-01
5,77E-01	5,82E-02
1,79E-01	1,86E-02
1,16E-01	3,85E-03
6,86E-02	7,48E-04

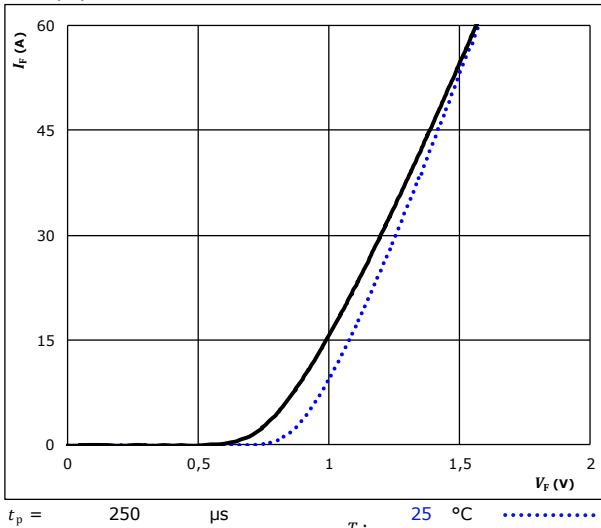


### Boost Sw. Protection Diode Characteristics

**figure 1. Rectifier Diode**

Typical forward characteristics

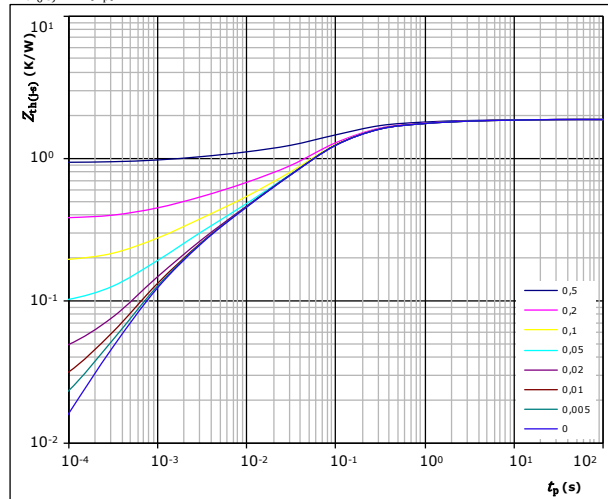
$$I_F = f(V_F)$$



**figure 2. Rectifier Diode**

Transient thermal impedance as a function of pulse width

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



$$D = \frac{t_p}{T}$$

$$R_{th(j-s)} = 1,87 \text{ K/W}$$

Diode thermal model values

R (K/W)	$\tau$ (s)
5,65E-02	8,90E+00
1,70E-01	1,08E+00
6,15E-01	1,58E-01
6,94E-01	5,21E-02
2,16E-01	6,16E-03
1,19E-01	1,06E-03

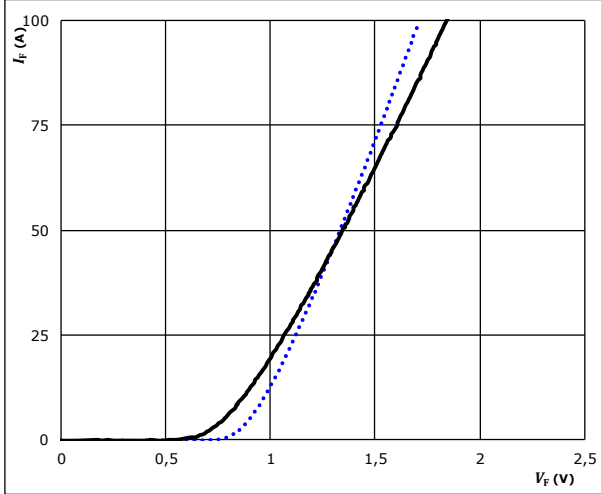


## ByPass Diode Characteristics

**figure 1.** FWD

Typical forward characteristics

$$I_F = f(V_F)$$

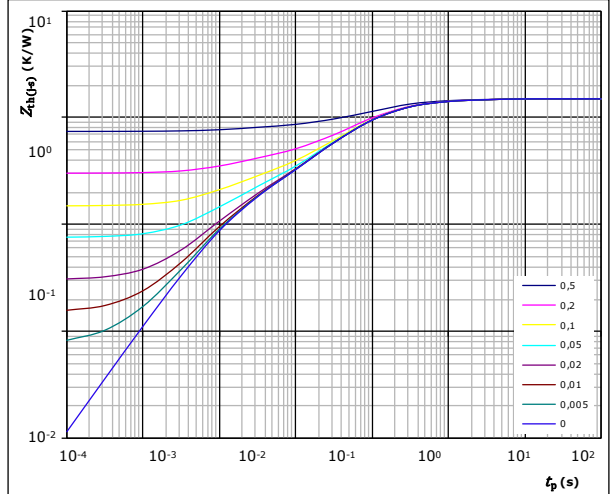


$t_p = 250 \mu s$   $T_j: 25 \text{ }^\circ\text{C}$  (dotted blue line)  $125 \text{ }^\circ\text{C}$  (solid black line)

**figure 2.** FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 1,50 \text{ K/W}$   
 FWD thermal model values

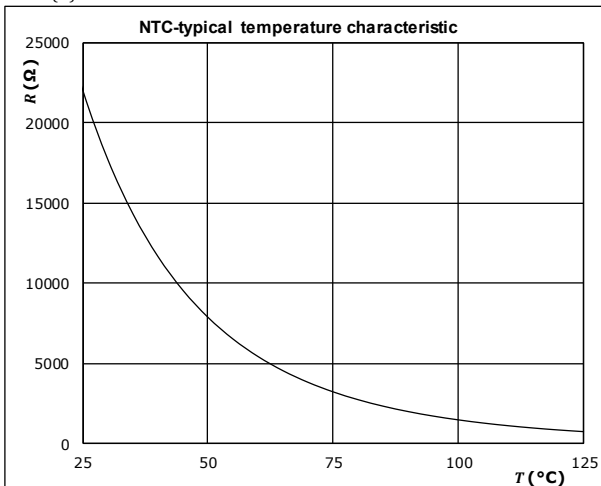
$R \text{ (K/W)}$	$\tau \text{ (s)}$
9,44E-02	2,48E+00
3,47E-01	3,51E-01
7,44E-01	7,63E-02
2,04E-01	1,21E-02
1,11E-01	1,25E-03

## Thermistor Characteristics

**figure 1.** Thermistor

Typical NTC characteristic as a function of temperature

$$R = f(T)$$



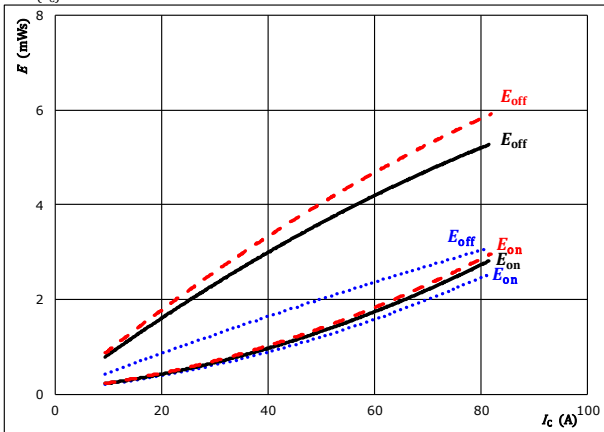


## Boost Switching Characteristics

**figure 1.** IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_c)$$



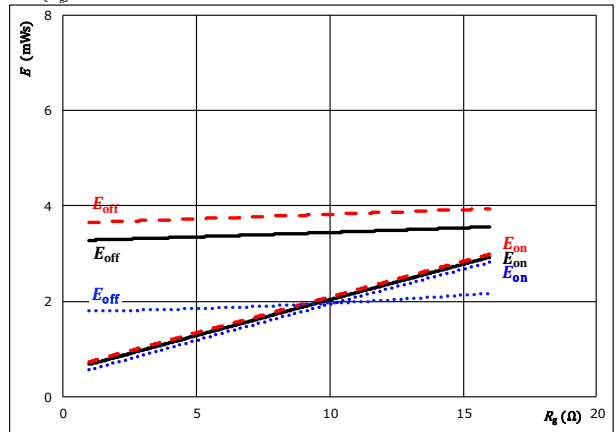
With an inductive load at

$V_{CE} = 700$ V	$T_j: 25$ °C	.....
$V_{GE} = 0 / 15$ V	$125$ °C	————
$R_{gon} = 4$ Ω	$150$ °C	-----
$R_{goff} = 4$ Ω		

**figure 2.** IGBT

Typical switching energy losses as a function of gate resistor

$$E = f(R_g)$$



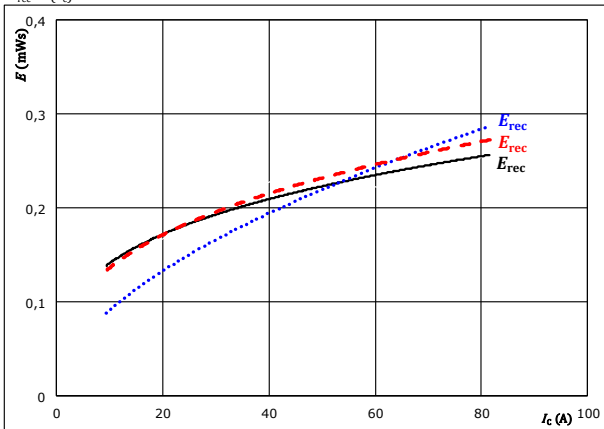
With an inductive load at

$V_{CE} = 700$ V	$T_j: 25$ °C	.....
$V_{GE} = 0 / 15$ V	$125$ °C	————
$I_c = 45$ A	$150$ °C	-----

**figure 3.** FWD

Typical reverse recovered energy loss as a function of collector current

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



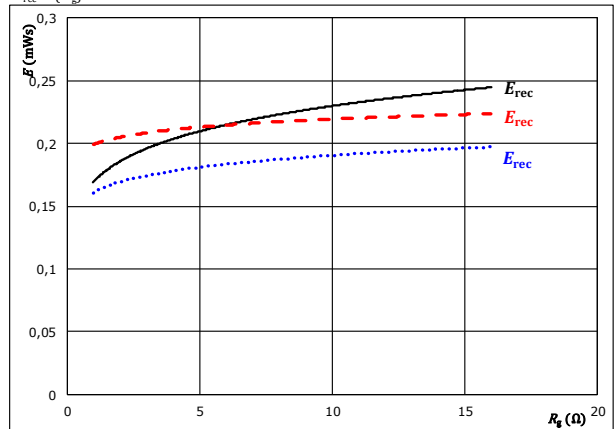
With an inductive load at

$V_{CE} = 700$ V	$T_j: 25$ °C	.....
$V_{GE} = 0 / 15$ V	$125$ °C	————
$R_{gon} = 4$ Ω	$150$ °C	-----

**figure 4.** FWD

Typical reverse recovered energy loss as a function of gate resistor

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



With an inductive load at

$V_{CE} = 700$ V	$T_j: 25$ °C	.....
$V_{GE} = 0 / 15$ V	$125$ °C	————
$I_c = 45$ A	$150$ °C	-----

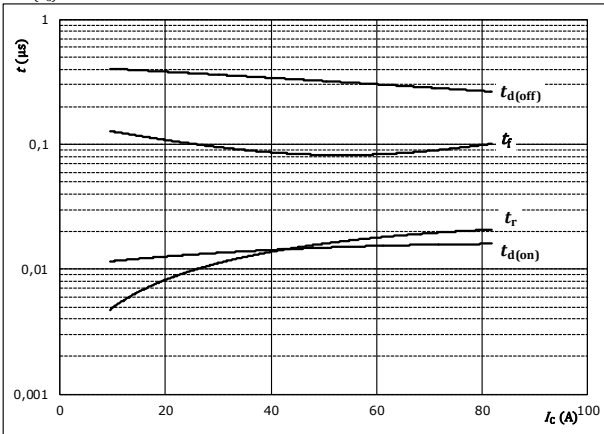


## Boost Switching Characteristics

**figure 5.** IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



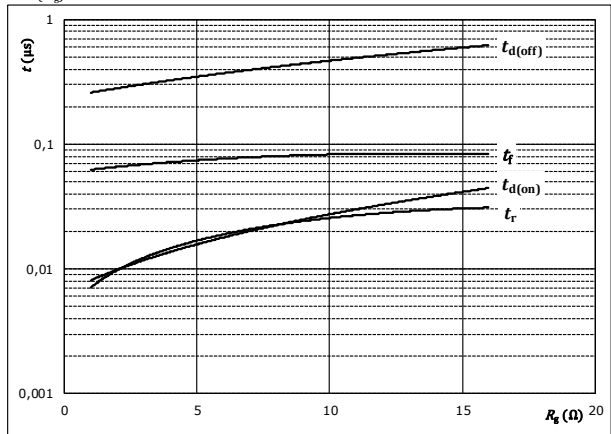
With an inductive load at

$T_j = 150$  °C  
 $V_{CE} = 700$  V  
 $V_{GE} = 0 / 15$  V  
 $R_{g\text{on}} = 4$  Ω  
 $R_{g\text{off}} = 4$  Ω

**figure 6.** IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



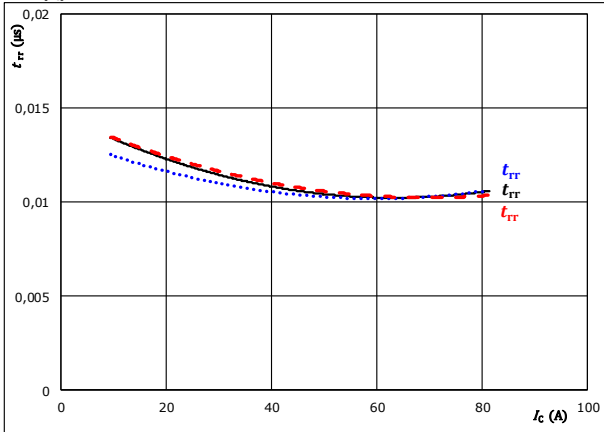
With an inductive load at

$T_j = 150$  °C  
 $V_{CE} = 700$  V  
 $V_{GE} = 0 / 15$  V  
 $I_C = 45$  A

**figure 7.** FWD

Typical reverse recovery time as a function of collector current

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



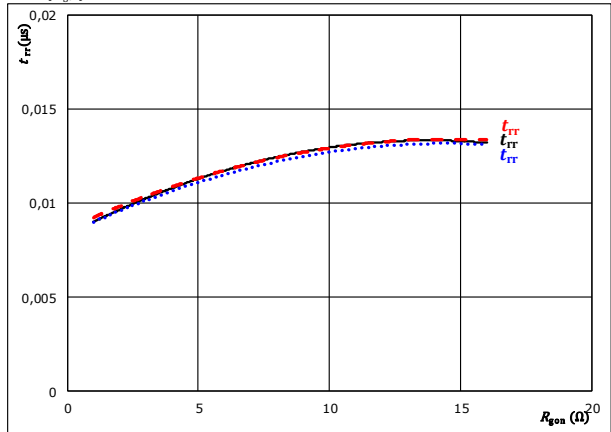
With an inductive load at

$V_{CE} = 700$  V  
 $V_{GE} = 0 / 15$  V  
 $R_{g\text{on}} = 4$  Ω  
 $T_j: 25$  °C (dotted line)  
 $125$  °C (solid line)  
 $150$  °C (dashed line)

**figure 8.** FWD

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

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



With an inductive load at

$V_{CE} = 700$  V  
 $V_{GE} = 0 / 15$  V  
 $I_C = 45$  A  
 $T_j: 25$  °C (dotted line)  
 $125$  °C (solid line)  
 $150$  °C (dashed line)

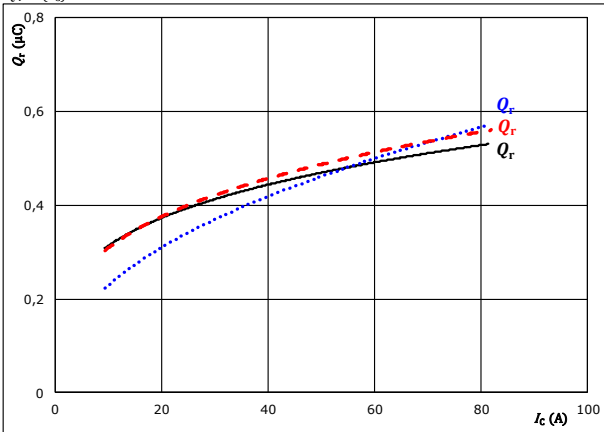


## Boost Switching Characteristics

**figure 9.** FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

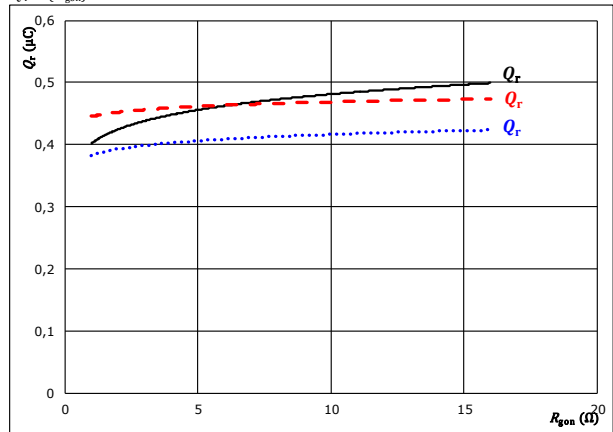


With an inductive load at  
 $V_{CE} = 700$  V  
 $V_{GE} = 0 / 15$  V  
 $R_{gon} = 4$   $\Omega$   
 $T_j$ : 25 °C (dotted blue), 125 °C (solid black), 150 °C (dashed red)

**figure 10.** FWD

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

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

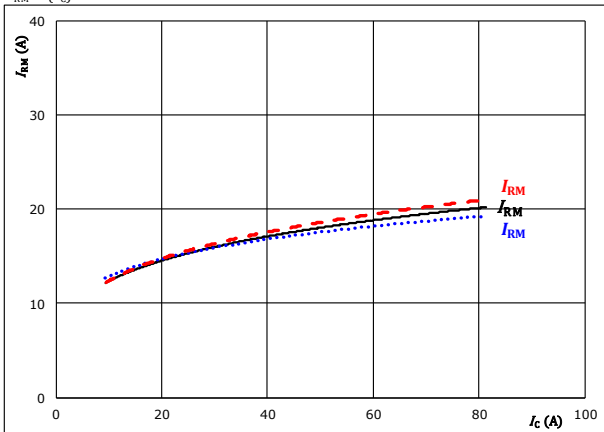


With an inductive load at  
 $V_{CE} = 700$  V  
 $V_{GE} = 0 / 15$  V  
 $I_C = 45$  A  
 $T_j$ : 25 °C (dotted blue), 125 °C (solid black), 150 °C (dashed red)

**figure 11.** FWD

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

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

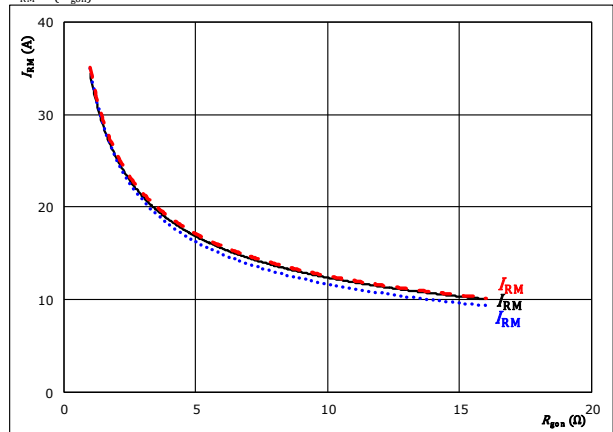


With an inductive load at  
 $V_{CE} = 700$  V  
 $V_{GE} = 0 / 15$  V  
 $R_{gon} = 4$   $\Omega$   
 $T_j$ : 25 °C (dotted blue), 125 °C (solid black), 150 °C (dashed red)

**figure 12.** FWD

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

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



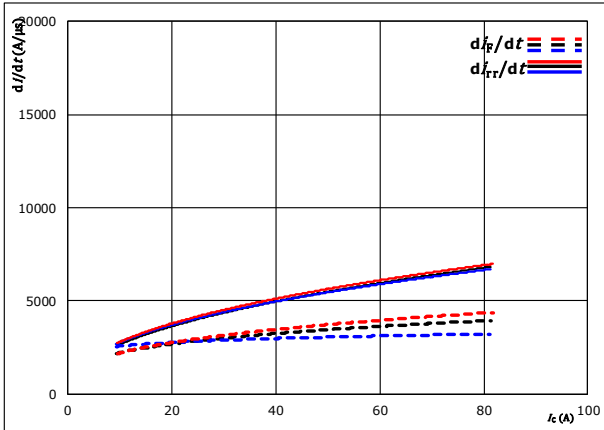
With an inductive load at  
 $V_{CE} = 700$  V  
 $V_{GE} = 0 / 15$  V  
 $I_C = 45$  A  
 $T_j$ : 25 °C (dotted blue), 125 °C (solid black), 150 °C (dashed red)



### Boost Switching Characteristics

**figure 13.** FWD

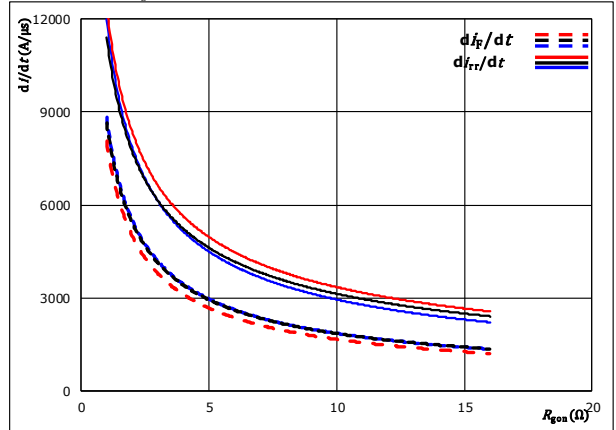
Typical rate of fall of forward and reverse recovery current as a function of collector current  
 $di_f/dt, di_{rr}/dt = f(I_C)$



With an inductive load at  
 $V_{CE} = 700$  V  
 $V_{GE} = 0 / 15$  V  
 $R_{g0n} = 4$   $\Omega$   
 $T_j: 25$  °C  
 $125$  °C  
 $150$  °C

**figure 14.** FWD

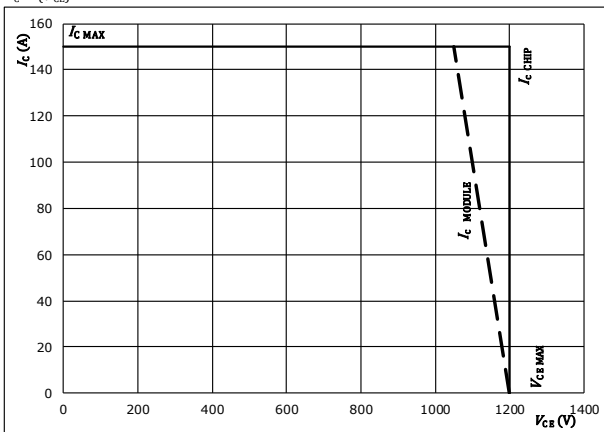
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor  
 $di_f/dt, di_{rr}/dt = f(R_{g0n})$



With an inductive load at  
 $V_{CE} = 700$  V  
 $V_{GE} = 0 / 15$  V  
 $I_C = 45$  A  
 $T_j: 25$  °C  
 $125$  °C  
 $150$  °C

**figure 15.** IGBT

Reverse bias safe operating area  
 $I_C = f(V_{CB})$



At  
 $T_j = 150$  °C  
 $R_{g0n} = 4$   $\Omega$   
 $R_{g0ff} = 4$   $\Omega$

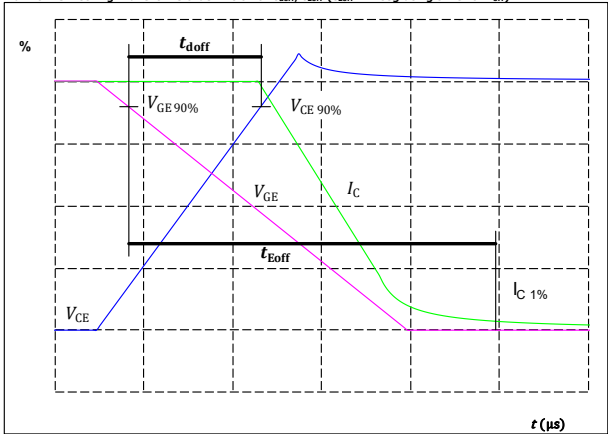


### Boost Switching Definitions

General conditions		
$T_j$	=	150 °C
$R_{gon}$	=	4 $\Omega$
$R_{goff}$	=	4 $\Omega$

figure 1. IGBT

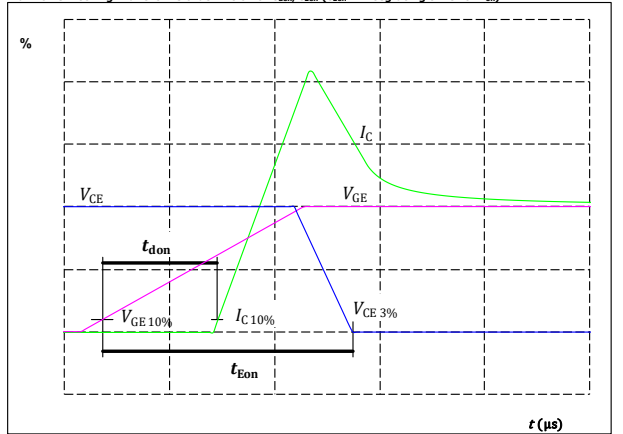
Turn-off Switching Waveforms & definition of  $t_{doff}$ ,  $t_{Eoff}$  ( $t_{Eoff}$  = integrating time for  $E_{off}$ )



$V_{CE}(0\%) =$	0	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	700	V
$I_C(100\%) =$	45	A
$t_{doff} =$	326	ns

figure 2. IGBT

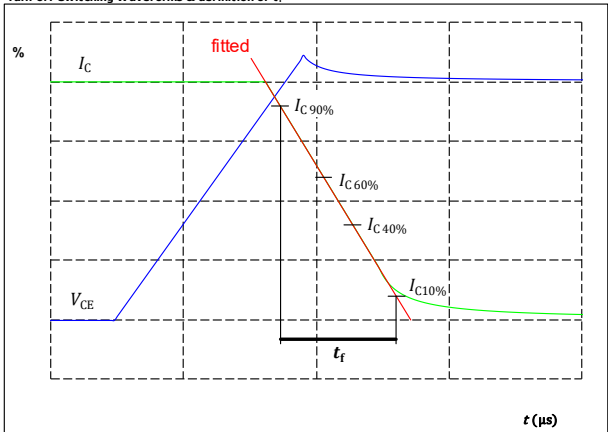
Turn-on Switching Waveforms & definition of  $t_{don}$ ,  $t_{Eon}$  ( $t_{Eon}$  = integrating time for  $E_{on}$ )



$V_{CE}(0\%) =$	0	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	700	V
$I_C(100\%) =$	45	A
$t_{don} =$	14	ns

figure 3. IGBT

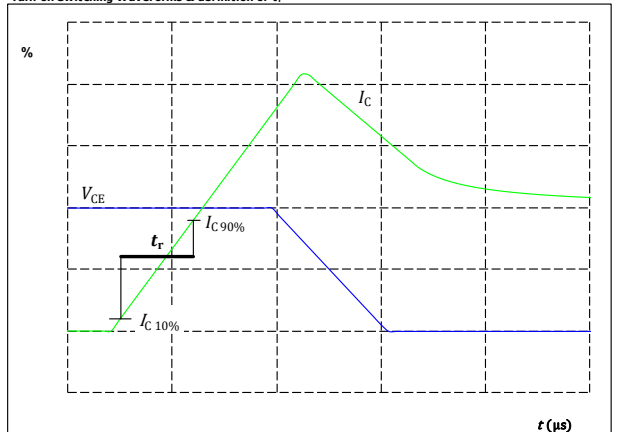
Turn-off Switching Waveforms & definition of  $t_f$



$V_C(100\%) =$	700	V
$I_C(100\%) =$	45	A
$t_f =$	72	ns

figure 4. IGBT

Turn-on Switching Waveforms & definition of  $t_r$



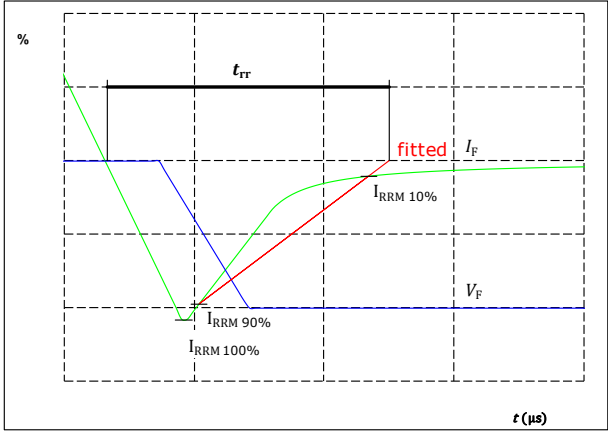
$V_{CE}(100\%) =$	700	V
$I_C(100\%) =$	45	A
$t_r =$	15	ns





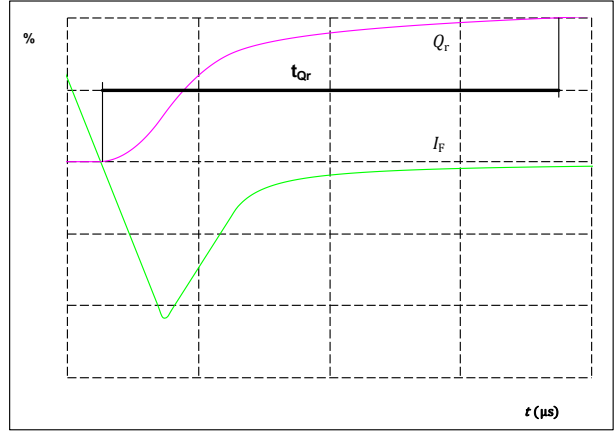
### Boost Switching Characteristics

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



$V_F(100\%) =$	700	V
$I_F(100\%) =$	45	A
$I_{RRM}(100\%) =$	20	A
$t_{rr} =$	11	ns

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



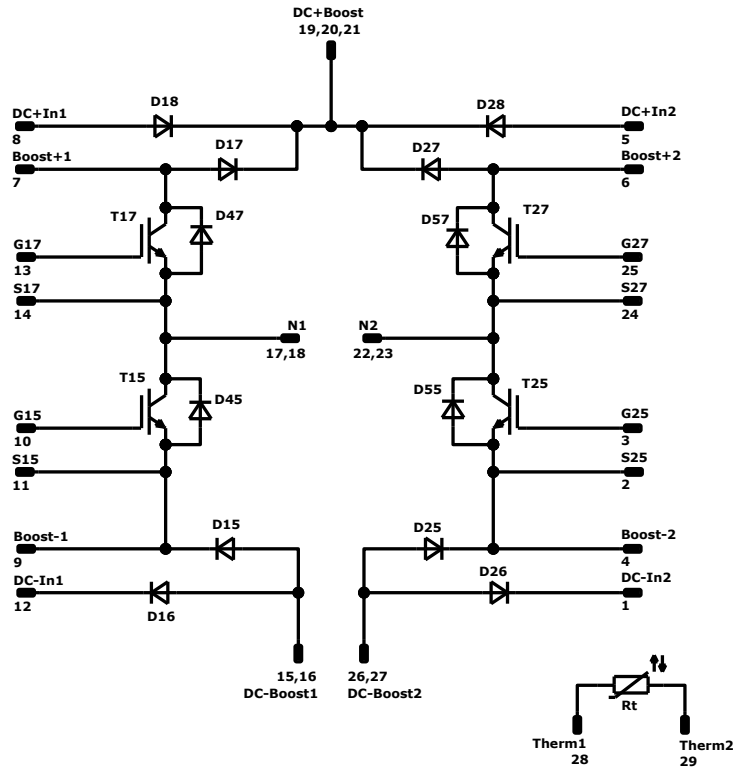
$I_F(100\%) =$	45	A
$Q_r(100\%) =$	0,43	$\mu C$





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**Pinout**



**Identification**

ID	Component	Voltage	Current	Function	Comment
T15, T17, T25, T27	IGBT	1200 V	75 A	Boost Switch	
D15, D17, D25, D27	FWD	1200 V	20 A	Boost Diode	
D45, D47, D55, D57	FWD	1600 V	18 A	Boost Sw. Protection Diode	
D16, D18, D26, D28	FWD	1600 V	28 A	ByPass Diode	
Rt	NTC			Thermistor	




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

Handling instruction
Handling instructions for <i>flow 1</i> packages see vincotech.com website.

Package data
Package data for <i>flow 1</i> 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-FY12S2A075SH-L860L48-D1-14	28 Aug. 2019		

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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.

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