
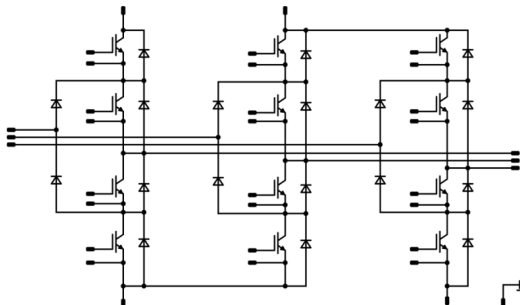




Vincotech

<i>flow 3xNPC 1</i>	1200 V / 50 A
<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; background-color: #cccccc; margin: 0;">Features</p> <ul style="list-style-type: none"> Four quadrant operation Enhanced thermal performance Fast switching IGBTs </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; background-color: #cccccc; margin: 0;">Target applications</p> <ul style="list-style-type: none"> Solar Inverters UPS </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; background-color: #cccccc; margin: 0;">Types</p> <ul style="list-style-type: none"> 10-PH07N3A050S5-M896F98T </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; background-color: #cccccc; margin: 0;"><i>flow 1 12 mm housing</i></p>  </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; background-color: #cccccc; margin: 0;">Schematic</p>  </div>

Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
Buck Switch				
Collector-emitter voltage	V_{CES}		650	V
Collector current	I_C		50	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	150	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	80	W
Gate-emitter voltage	V_{GES}		±20	V
Maximum junction temperature	T_{jmax}		175	°C



Vincotech

Maximum Ratings

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

Parameter	Symbol	Condition	Value	Unit
Buck Diode				
Peak repetitive reverse voltage	V_{RRM}		650	V
Continuous (direct) forward current	I_F		50	A
Repetitive peak forward current	I_{FRM}		100	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	71	W
Maximum junction temperature	T_{jmax}		175	°C
Boost Switch				
Collector-emitter voltage	V_{CES}		650	V
Collector current	I_C		50	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	150	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	80	W
Gate-emitter voltage	V_{GES}		±20	V
Maximum junction temperature	T_{jmax}		175	°C
Boost Diode				
Peak repetitive reverse voltage	V_{RRM}		650	V
Continuous (direct) forward current	I_F		50	A
Repetitive peak forward current	I_{FRM}		100	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	71	W
Maximum junction temperature	T_{jmax}		175	°C
Boost Sw.Inv.Diode				
Peak repetitive reverse voltage	V_{RRM}		650	V
Continuous (direct) forward current	I_F		50	A
Repetitive peak forward current	I_{FRM}		100	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	71	W
Maximum junction temperature	T_{jmax}		175	°C



Vincotech

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 _{max} - 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			9,4	mm
Comparative Tracking Index	CTI		> 200	

*100 % tested in production



Vincotech

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	

Buck 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	$V_{GE(th)}$	$V_{GE} = V_{CE}$				0,0005	25	3,2	4	4,8	V
Collector-emitter saturation voltage	V_{CEsat}		15			50	25 125 150		1,35 1,41 1,43	1,75	V
Collector-emitter cut-off current	I_{CES}		0	650			25			50	μA
Gate-emitter leakage current	I_{GES}		20	0			25			100	nA
Internal gate resistance	r_g								none		Ω
Input capacitance	C_{ies}	$f = 1$ Mhz	0	25			25		3100		pF
Reverse transfer capacitance	C_{res}								12		
Gate charge	Q_g		15	650	50	25			120		

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	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)							1,19		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	$t_{d(on)}$	$R_{goff} = 8 \Omega$ $R_{gon} = 8 \Omega$	±15	350	51			25	65		ns
Rise time	t_r							125	67		
								150	70		
								25	8		
Turn-off delay time	$t_{d(off)}$							125	8		
								150	9		
		25	85								
Fall time	t_f	125	100								
		150	104								
		25	12								
Turn-on energy (per pulse)	E_{on}	$Q_{t-FWD} = 1,8 \mu C$ $Q_{t-FWD} = 3,3 \mu C$ $Q_{t-FWD} = 3,6 \mu C$						0,426		mWs	
								125			0,578
								150			0,522
Turn-off energy (per pulse)	E_{off}							0,393		mWs	
								125			0,645
								150			0,785



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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		

Buck Diode

Static

Forward voltage	V_F				50	25 125 150		1,50 1,44 1,42	1,77	V
Reverse leakage current	I_R			650		25			2,65	μA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,34		K/W
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Dynamic

Peak recovery current	I_{RRM}					25 125 150		95 114 112		A
Reverse recovery time	t_{rr}					25 125 150		28 66 73		ns
Recovered charge	Q_r	$di/dt = 8774$ A/μs $di/dt = 8156$ A/μs $di/dt = 7634$ A/μs	±15	350	51	25 125 150		1,83 3,26 3,59		μC
Reverse recovered energy	E_{rec}					25 125 150		0,476 0,865 1,06		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		8284 7934 6988		A/μs



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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	

Boost 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	$V_{GE(th)}$	$V_{GE} = V_{CE}$				0,0005	25	3,2	4	4,8	V
Collector-emitter saturation voltage	V_{CESat}		15			50	25 125 150		1,35 1,41 1,43	1,75	V
Collector-emitter cut-off current	I_{CES}		0	650			25			50	μA
Gate-emitter leakage current	I_{GES}		20	0			25			100	nA
Internal gate resistance	r_g								0		Ω
Input capacitance	C_{ies}								3100		pF
Output capacitance	C_{oes}	$f = 1$ Mhz	0	25		25					
Reverse transfer capacitance	C_{res}								12		
Gate charge	Q_g		15	650	50		25		120		

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	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)							1,19		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	$t_{d(on)}$						25 125 150		64 69 69		ns
Rise time	t_r	$R_{goff} = 8$ Ω $R_{gon} = 8$ Ω					25 125 150		8 10 10		
Turn-off delay time	$t_{d(off)}$		±15	350	50		25 125 150		84 99 104		
Fall time	t_f						25 125 150		12 24 31		
Turn-on energy (per pulse)	E_{on}	$Q_{iFWD} = 1,8$ μC $Q_{iFWD} = 3,1$ μC $Q_{iFWD} = 3,5$ μC					25 125 150		0,433 0,493 0,577		
Turn-off energy (per pulse)	E_{off}						25 125 150		0,356 0,690 0,796		



Vincotech

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_F [A]	T_j [°C]	Min	Typ	Max	

Boost Diode

Static

Forward voltage	V_F				50	25 125 150		1,50 1,44 1,42	1,77	V
Reverse leakage current	I_R				650	25			2,65	μ A

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,34		K/W
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Dynamic

Peak recovery current	I_{RRM}					25 125 150		53 62 66		A
Reverse recovery time	t_{rr}					25 125 150		59 104 114		ns
Recovered charge	Q_r	$di/dt = 5964$ A/ μ s $di/dt = 5166$ A/ μ s $di/dt = 5070$ A/ μ s	± 15	350	50	25 125 150		1,811 3,086 3,531		μ C
Reverse recovered energy	E_{rec}					25 125 150		0,471 0,867 0,988		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		621 439 580		A/ μ s

Boost Sw.Inv.Diode

Static

Forward voltage	V_F				50	25 125 150		1,50 1,44 1,42	1,77	V
Reverse leakage current	I_R				650	25			2,65	μ A

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,34		K/W
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Vincotech

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	

Thermistor

Rated resistance	R				25		22		kΩ
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	

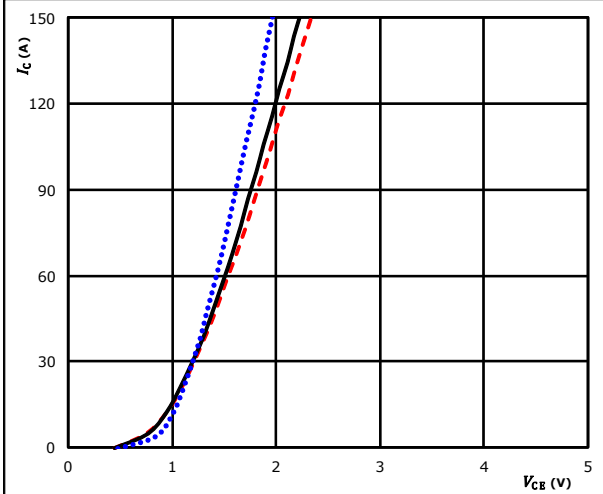


Buck Switch Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

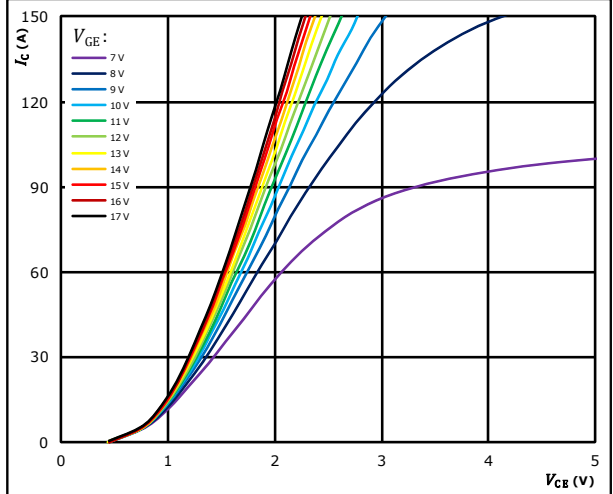


$t_p = 250 \mu s$ $T_j: 25 \text{ }^\circ C$
 $V_{GE} = 15 \text{ V}$ $T_j: 125 \text{ }^\circ C$ ———
 $T_j: 150 \text{ }^\circ C$ - - - -

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

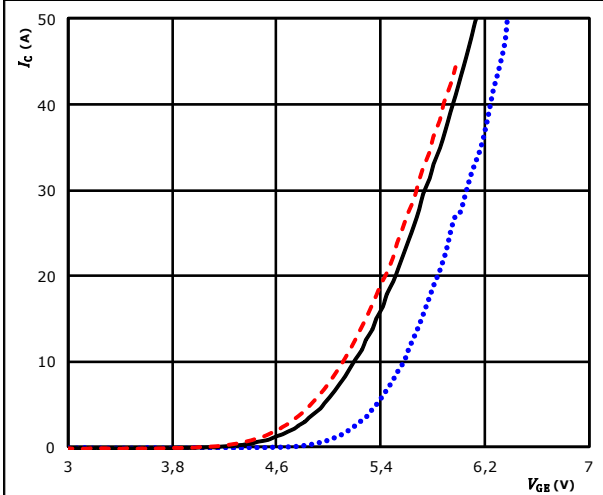


$t_p = 250 \mu s$
 $T_j = 150 \text{ }^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

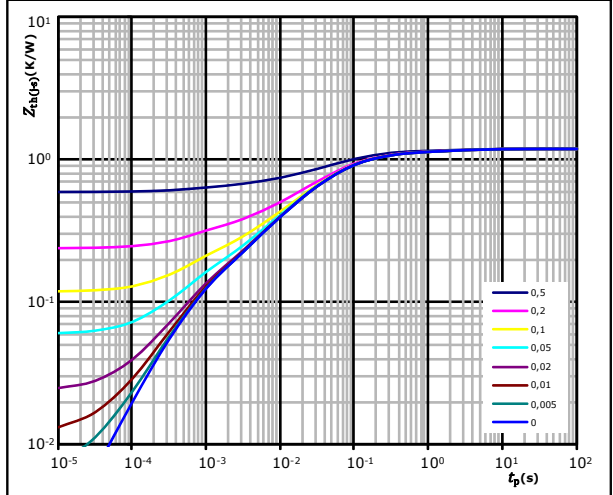


$t_p = 100 \mu s$ $T_j: 25 \text{ }^\circ C$
 $V_{CE} = 10 \text{ V}$ $T_j: 125 \text{ }^\circ C$ ———
 $T_j: 150 \text{ }^\circ C$ - - - -

figure 4. IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$
 $R_{th(j-s)} = 1,19 \text{ K/W}$

IGBT thermal model values

R (K/W)	τ (s)
6,04E-02	2,95E+00
1,06E-01	4,21E-01
4,63E-01	6,99E-02
3,28E-01	1,96E-02
1,38E-01	4,59E-03
9,72E-02	5,47E-04

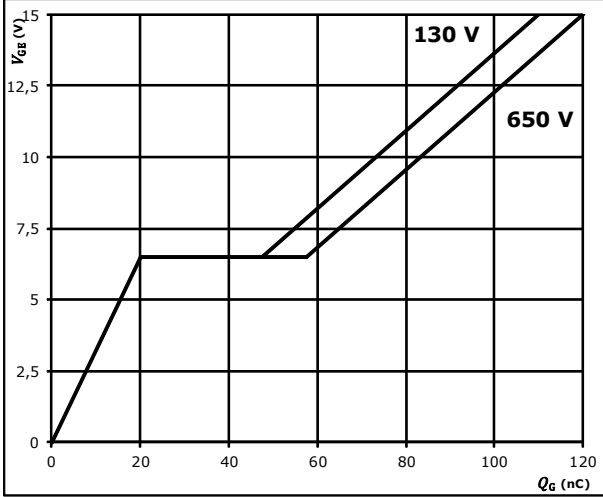


Buck Switch Characteristics

figure 5. IGBT

Gate voltage vs gate charge

$V_{GE} = f(Q_G)$

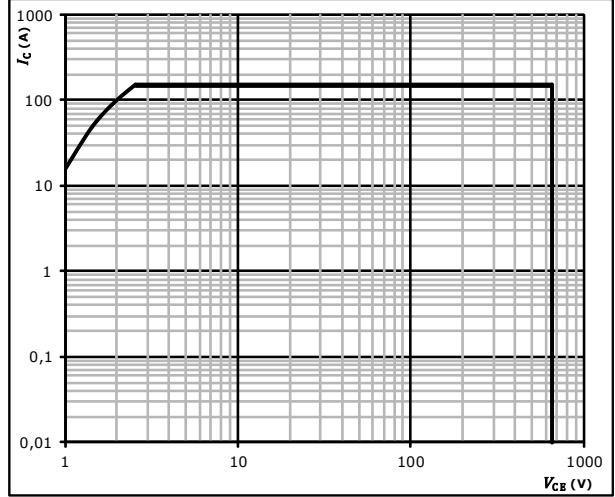


$I_C = 50$ A

figure 6. IGBT

Safe operating area

$I_C = f(V_{CE})$



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

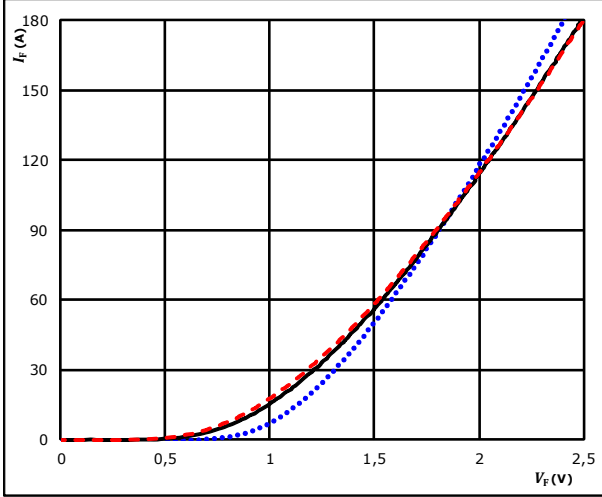


Buck Diode Characteristics

figure 1. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

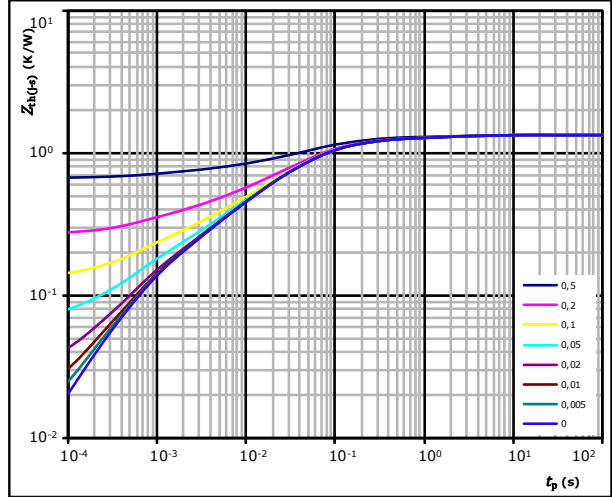


$t_p = 250 \mu s$
 T_j : 25 °C
 125 °C ———
 150 °C - - - -

figure 2. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,34 \text{ K/W}$

FWD thermal model values

R (K/W)	τ (s)
8,55E-02	2,12E+00
1,17E-01	2,95E-01
5,19E-01	6,24E-02
3,35E-01	2,10E-02
1,66E-01	4,73E-03
1,14E-01	6,78E-04

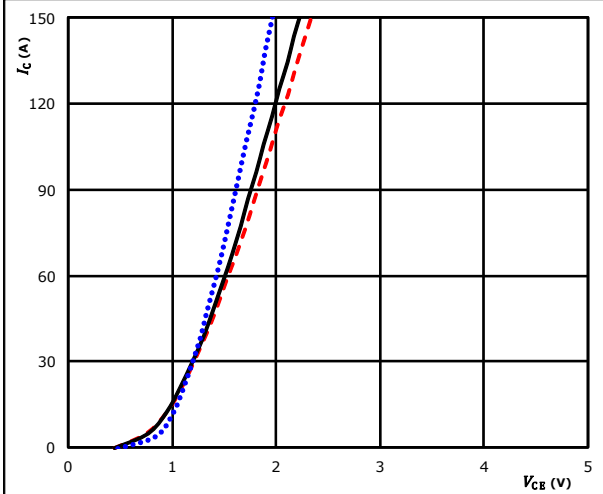


Boost Switch Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

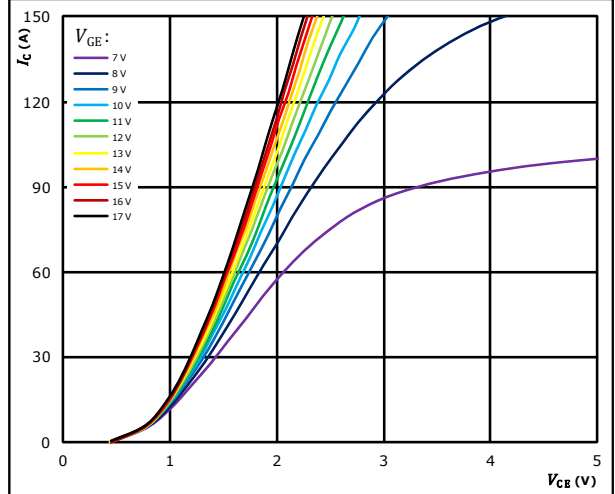


$t_p = 250 \mu s$ $T_j: 25 \text{ }^\circ C$
 $V_{GE} = 15 \text{ V}$ $T_j: 125 \text{ }^\circ C$ ———
 $T_j: 150 \text{ }^\circ C$ - - - -

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

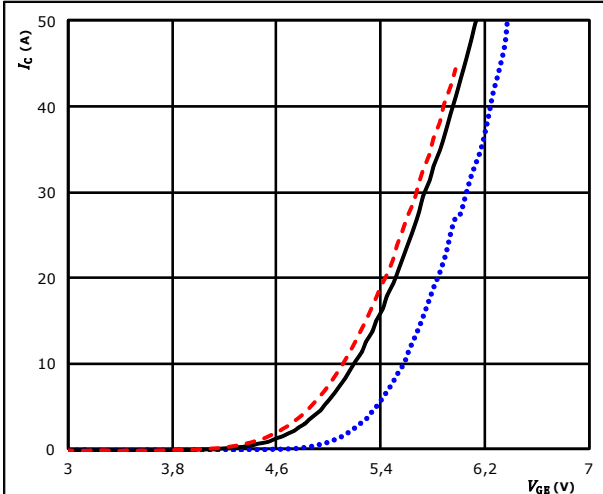


$t_p = 250 \mu s$
 $T_j = 150 \text{ }^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

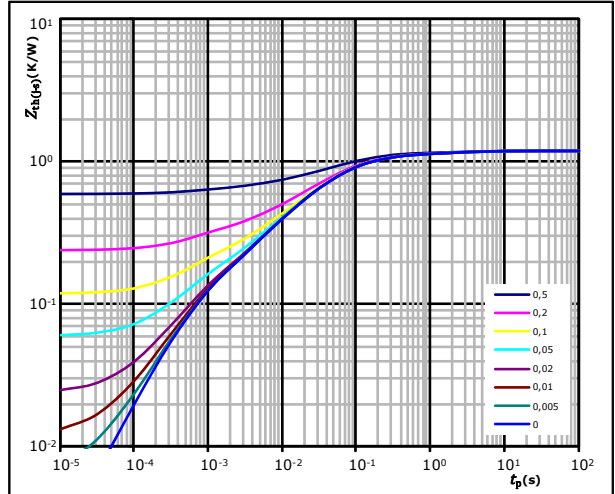


$t_p = 100 \mu s$ $T_j: 25 \text{ }^\circ C$
 $V_{CE} = 10 \text{ V}$ $T_j: 125 \text{ }^\circ C$ ———
 $T_j: 150 \text{ }^\circ C$ - - - -

figure 4. IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$
 $R_{th(j-s)} = 1,19 \text{ K/W}$

IGBT thermal model values

R (K/W)	τ (s)
6,04E-02	2,95E+00
1,06E-01	4,21E-01
4,63E-01	6,99E-02
3,28E-01	1,96E-02
1,38E-01	4,59E-03
9,72E-02	5,47E-04

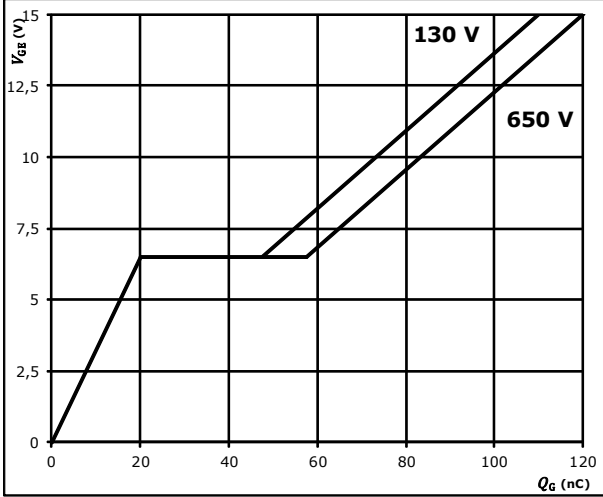


Boost Switch Characteristics

figure 5. IGBT

Gate voltage vs gate charge

$V_{GE} = f(Q_G)$

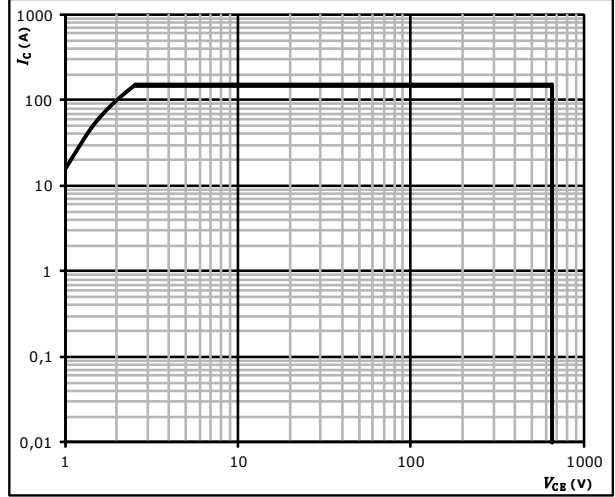


$I_C = 50$ A

figure 6. IGBT

Safe operating area

$I_C = f(V_{CE})$



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

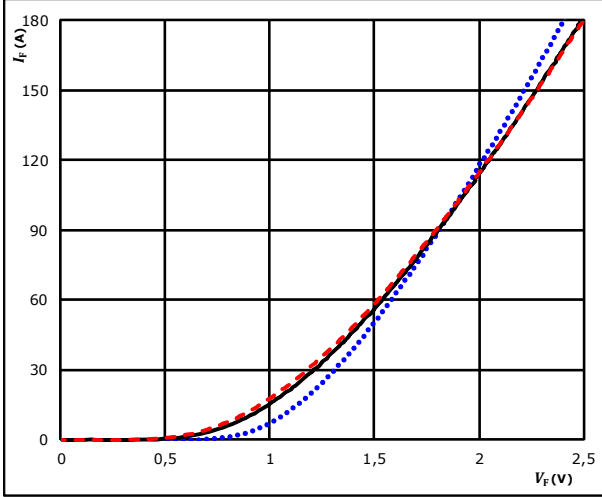


Boost Diode Characteristics

figure 1. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

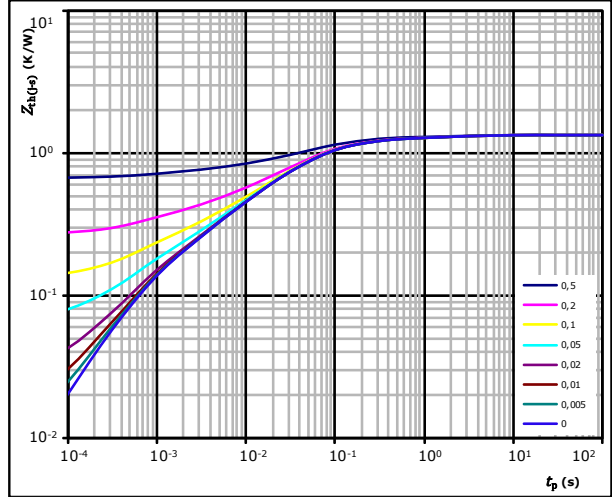


$t_p = 250 \mu s$
 T_j : 25 °C
 125 °C ———
 150 °C - - - -

figure 2. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,34 \text{ K/W}$

FWD thermal model values

R (K/W)	τ (s)
8,55E-02	2,12E+00
1,17E-01	2,95E-01
5,19E-01	6,24E-02
3,35E-01	2,10E-02
1,66E-01	4,73E-03
1,14E-01	6,78E-04

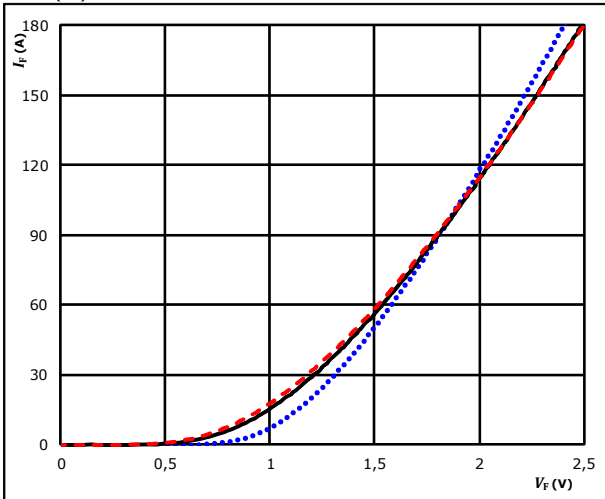


Boost Sw.Inv.Diode Characteristics

figure 1. Inverse Diode

Typical forward characteristics

$$I_F = f(V_F)$$

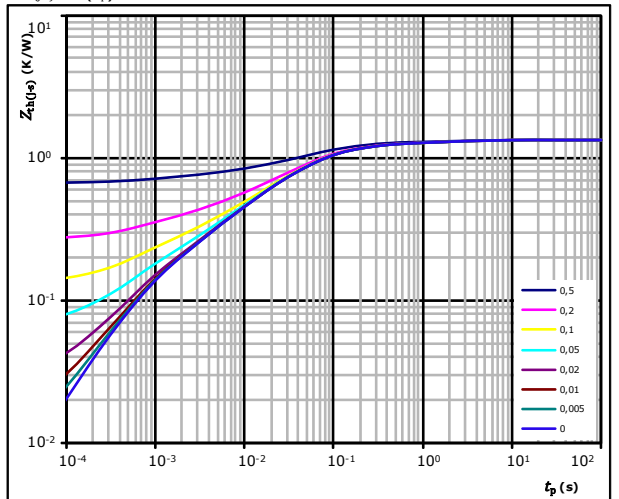


$t_p = 250 \mu s$
 T_j : 25 °C
 125 °C ———
 150 °C - - - -

figure 2. Inverse Diode

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(\theta-s)} = 1,34 \text{ K/W}$
 Inverse Diode thermal model values

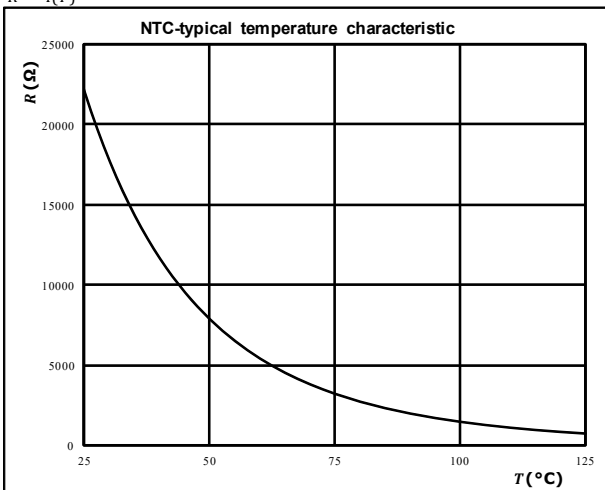
R (K/W)	τ (s)
8,55E-02	2,12E+00
1,17E-01	2,95E-01
5,19E-01	6,24E-02
3,35E-01	2,10E-02
1,66E-01	4,73E-03
1,14E-01	6,78E-04

Thermistor Characteristics

figure 1. Thermistor

Typical NTC characteristic as a function of temperature

$$R = f(T)$$

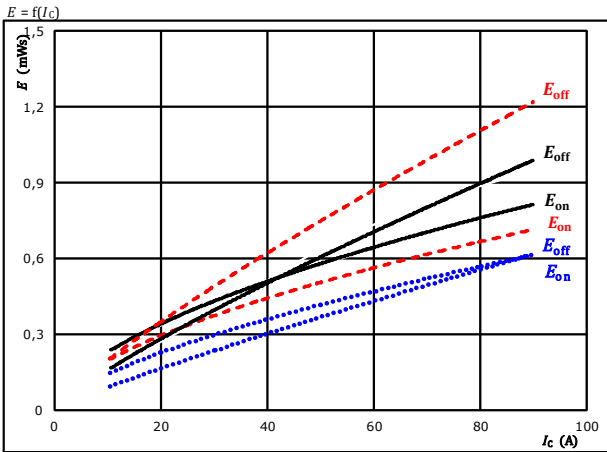




Buck Switching Characteristics

figure 1. IGBT

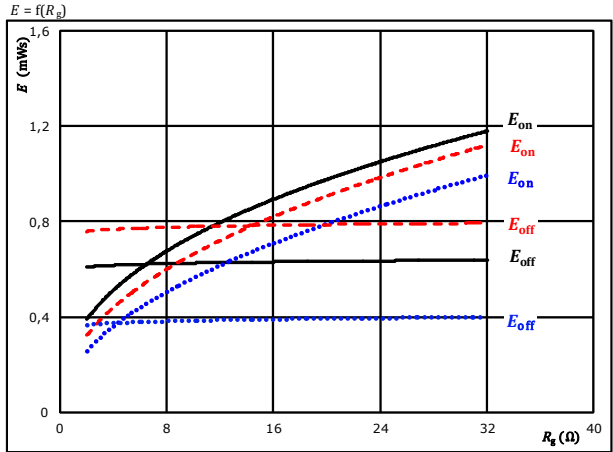
Typical switching energy losses as a function of collector current



With an inductive load at
 $V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $R_{g(on)} = 8$ Ω
 $R_{g(off)} = 8$ Ω
 T_j : 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

figure 2. IGBT

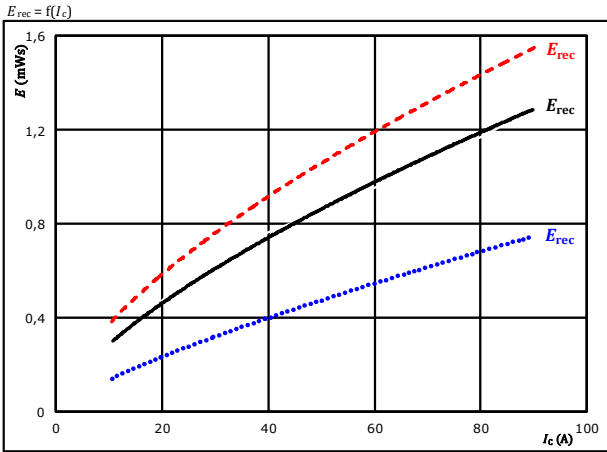
Typical switching energy losses as a function of gate resistor



With an inductive load at
 $V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $I_C = 51$ A
 T_j : 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

figure 3. FWD

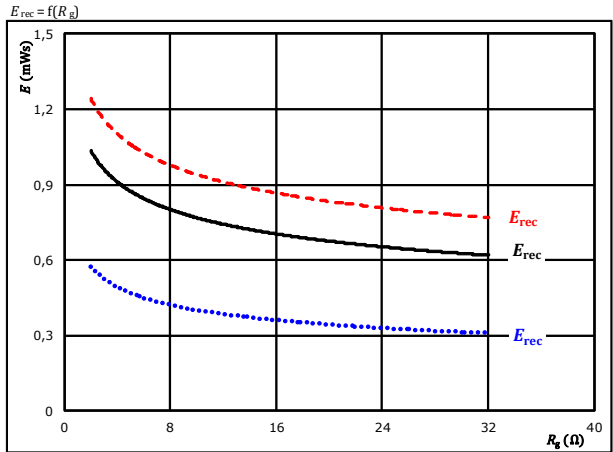
Typical reverse recovered energy loss as a function of collector current



With an inductive load at
 $V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $R_{g(on)} = 8$ Ω
 T_j : 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

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
 $I_C = 51$ A
 T_j : 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

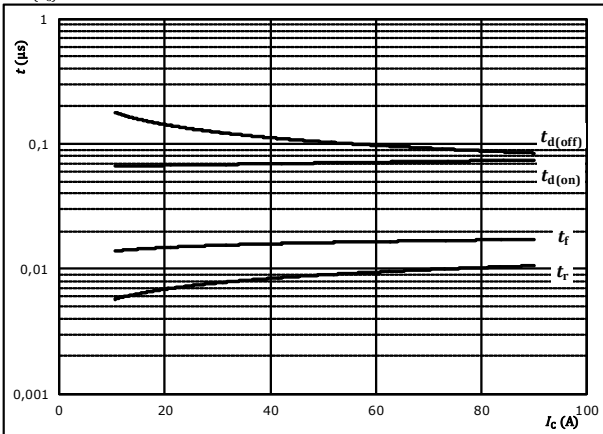


Buck Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



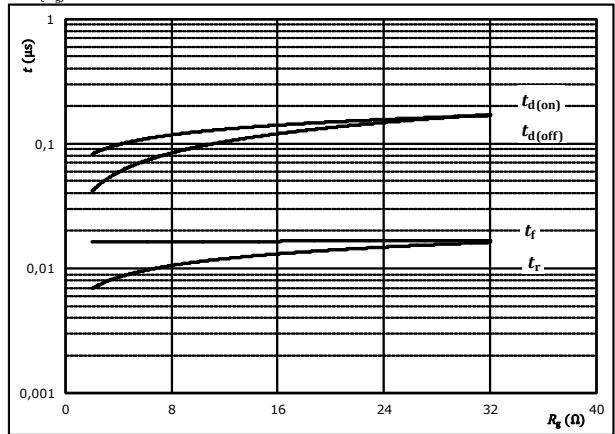
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$R_{g(on)} =$	8	Ω
$R_{g(off)} =$	8	Ω

figure 6. IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



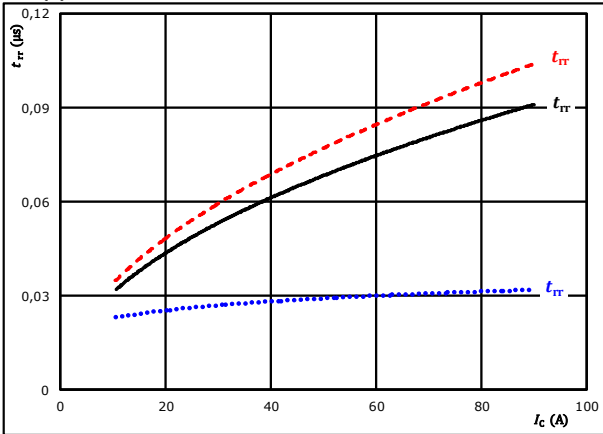
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$I_C =$	51	A

figure 7. FWD

Typical reverse recovery time as a function of collector current

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

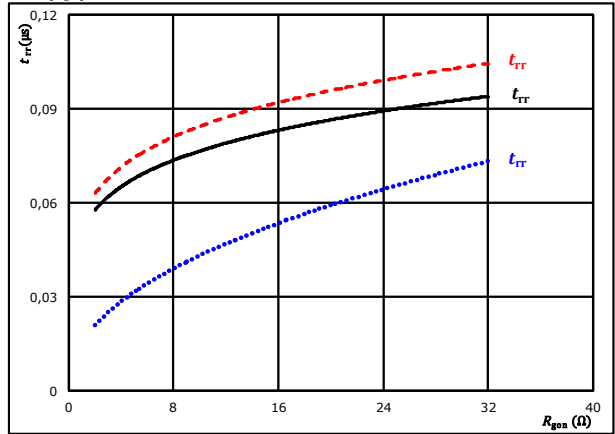


At	$V_{CE} =$	350	V	$T_j =$	25 °C
	$V_{GE} =$	±15	V		125 °C	————
	$R_{g(on)} =$	8	Ω		150 °C	- - - -

figure 8. FWD

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

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



At	$V_{CE} =$	350	V	$T_j =$	25 °C
	$V_{GE} =$	±15	V		125 °C	————
	$I_C =$	51	A		150 °C	- - - -

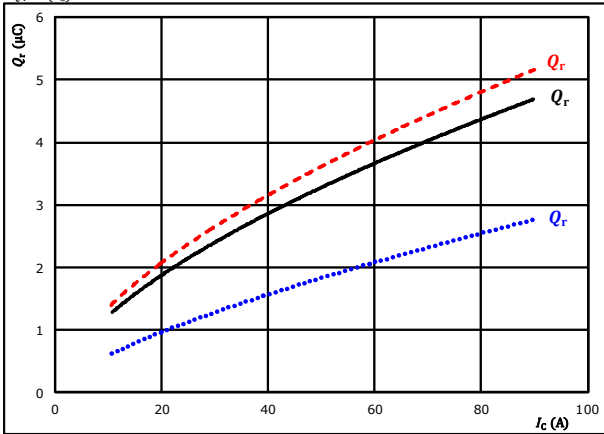


Buck Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

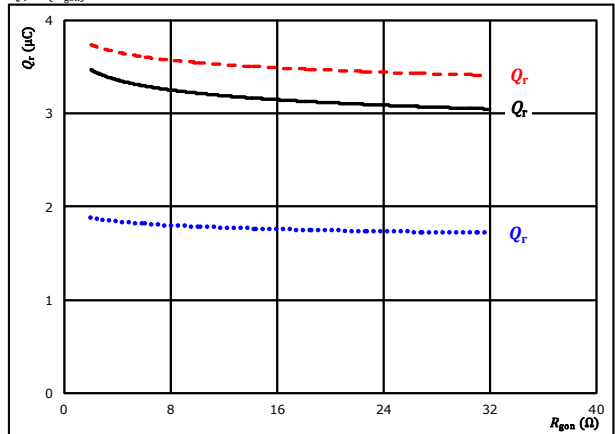


At $V_{CE} = 350$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C ———
 $R_{gpn} = 8$ Ω $T_j = 150$ °C - - - - -

figure 10. FWD

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

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

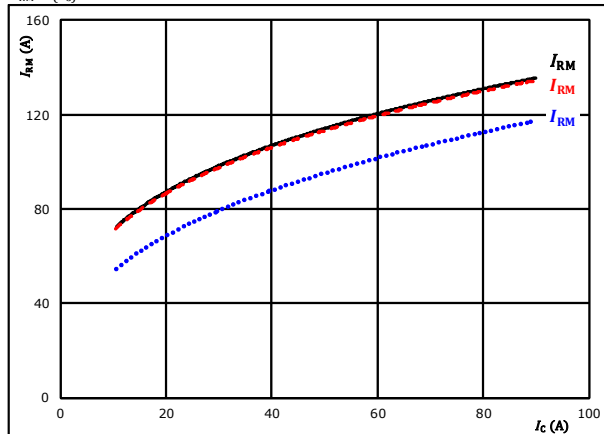


At $V_{CE} = 350$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C ———
 $I_c = 51$ A $T_j = 150$ °C - - - - -

figure 11. FWD

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

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

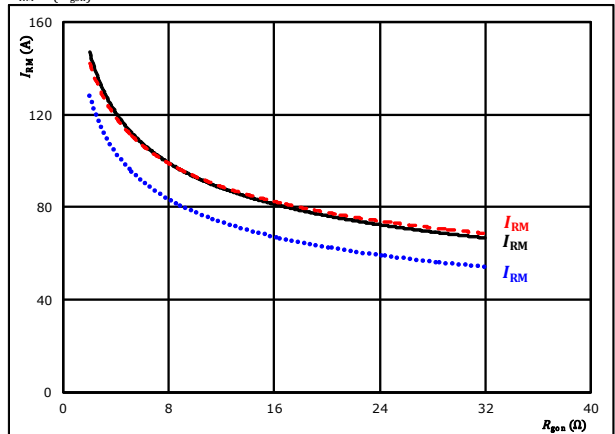


At $V_{CE} = 350$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C ———
 $R_{gpn} = 8$ Ω $T_j = 150$ °C - - - - -

figure 12. FWD

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

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



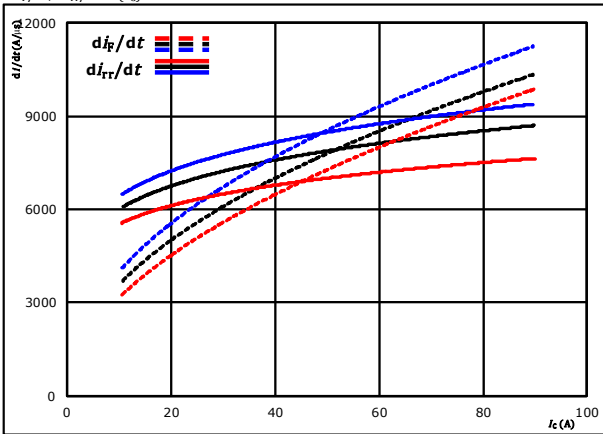
At $V_{CE} = 350$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C ———
 $I_c = 51$ A $T_j = 150$ °C - - - - -



Buck Switching Characteristics

figure 13. FWD

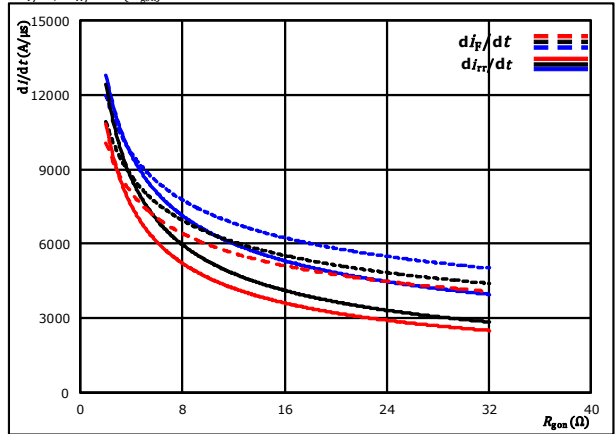
Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_f/dt, di_{rr}/dt = f(I_c)$



At $V_{CE} = 350$ V $T_j = 25$ °C (.....)
 $V_{GE} = \pm 15$ V $T_j = 125$ °C (—)
 $R_{g(on)} = 8$ Ω $T_j = 150$ °C (---)

figure 14. FWD

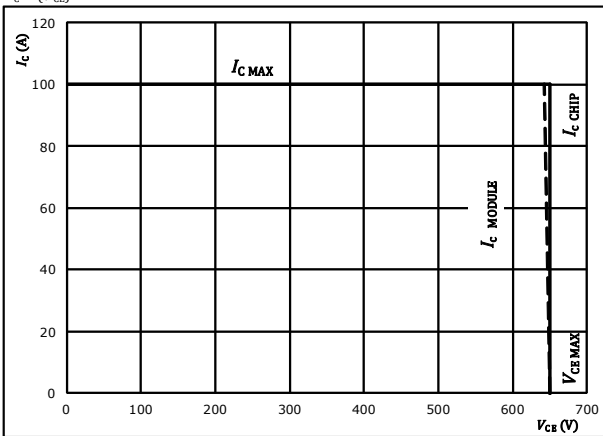
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
 $di_f/dt, di_{rr}/dt = f(R_{g(on)})$



At $V_{CE} = 350$ V $T_j = 25$ °C (.....)
 $V_{GE} = \pm 15$ V $T_j = 125$ °C (—)
 $I_c = 51$ A $T_j = 150$ °C (---)

figure 15. IGBT

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



At $T_j = 175$ °C
 $R_{g(on)} = 8$ Ω
 $R_{g(off)} = 8$ Ω



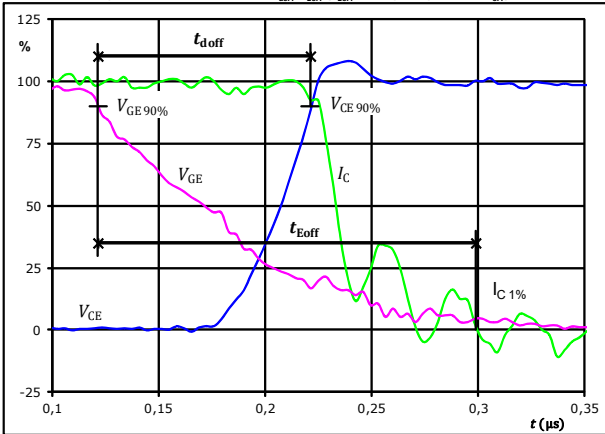
Buck Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	8 Ω
R_{goff}	=	8 Ω

figure 1. IGBT

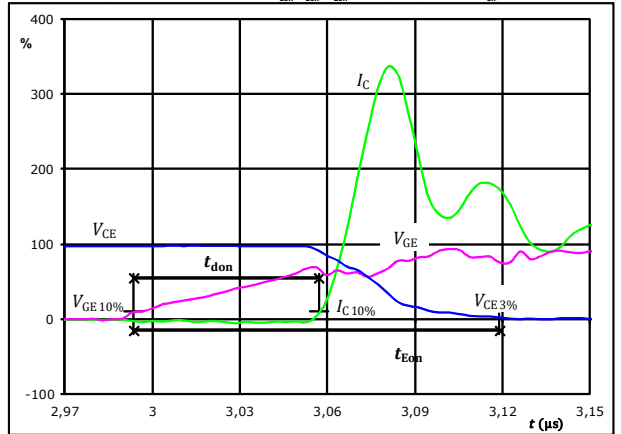
Turn-off Switching Waveforms & definition of t_{doff} , t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{CE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	51	A
$t_{doff} =$	0,100	μs
$t_{Eoff} =$	0,177	μs

figure 2. IGBT

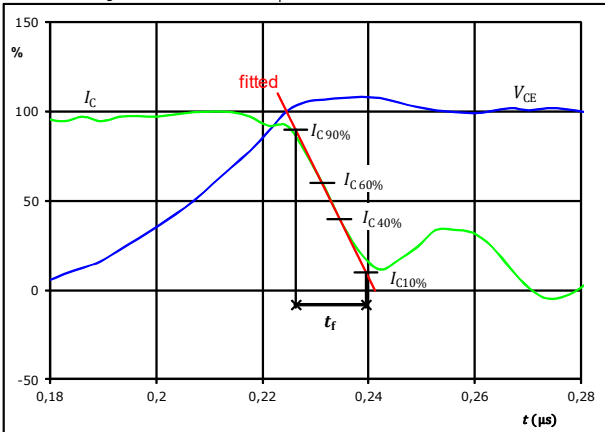
Turn-on Switching Waveforms & definition of t_{don} , t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{CE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	51	A
$t_{don} =$	0,067	μs
$t_{Eon} =$	0,125	μs

figure 3. IGBT

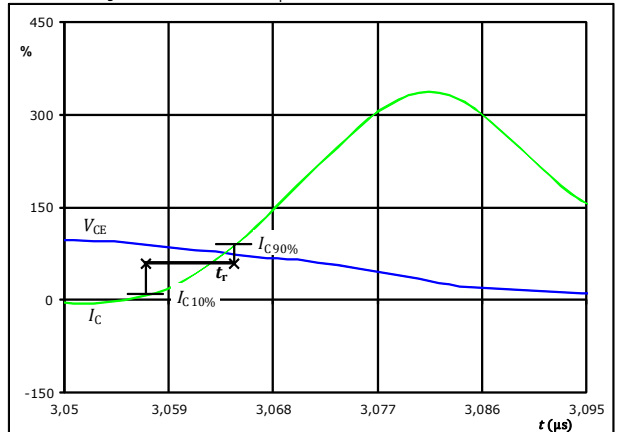
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%) =$	350	V
$I_C(100\%) =$	51	A
$t_f =$	0,015	μs

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r



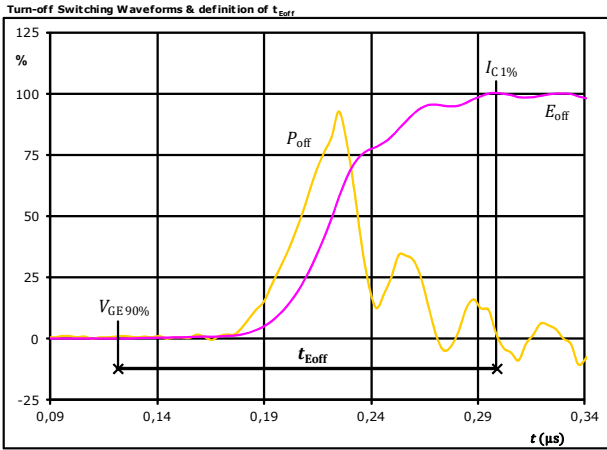
$V_C(100\%) =$	350	V
$I_C(100\%) =$	51	A
$t_r =$	0,008	μs



Vincotech

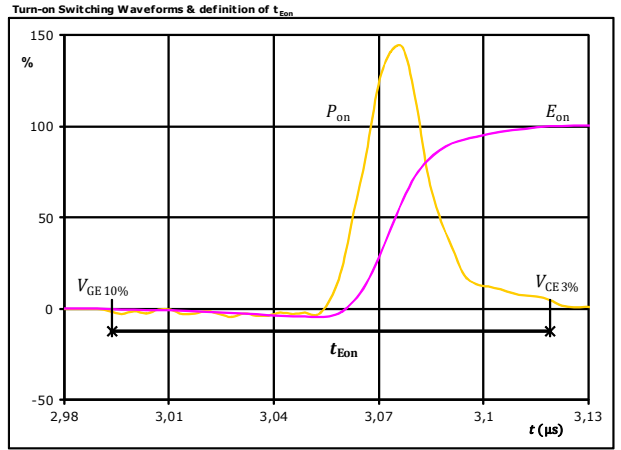
Buck Switching Characteristics

figure 5. IGBT



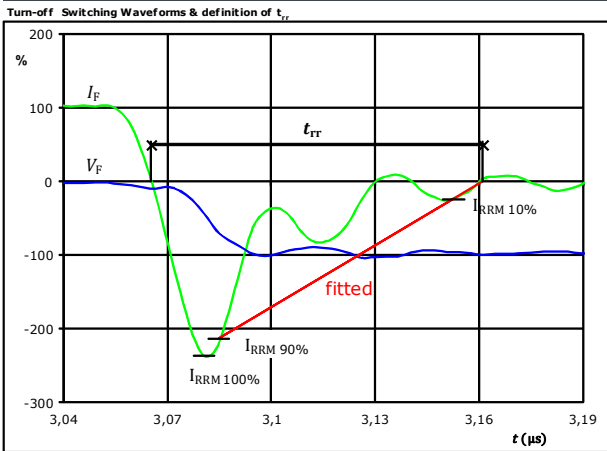
$P_{off}(100\%) =$	17,77	kW
$E_{off}(100\%) =$	0,65	mJ
$t_{Eoff} =$	0,18	µs

figure 6. IGBT



$P_{on}(100\%) =$	17,77	kW
$E_{on}(100\%) =$	0,58	mJ
$t_{Eon} =$	0,13	µs

figure 7. FWD



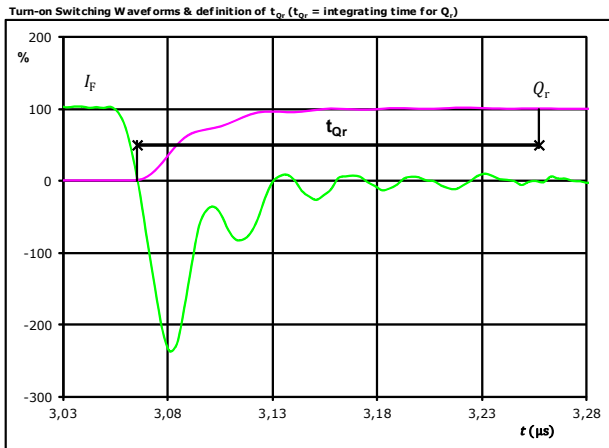
$V_F(100\%) =$	350	V
$I_F(100\%) =$	51	A
$I_{RRM}(100\%) =$	-114	A
$t_{tr} =$	0,066	µs



Vincotech

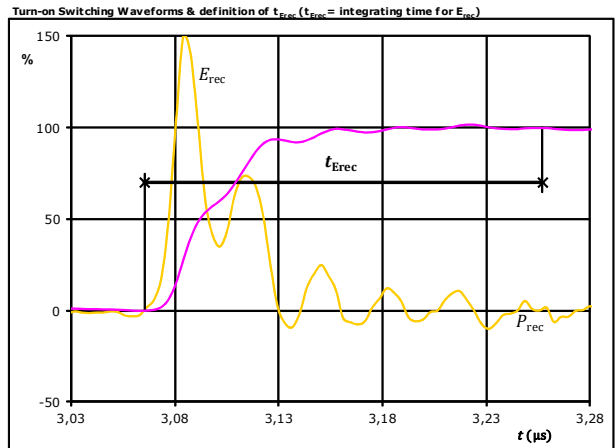
Buck Switching Characteristics

figure 8. FWD



I_F (100%) =	51	A
Q_r (100%) =	3,26	μC
t_{Qr} =	0,19	μs

figure 9. FWD

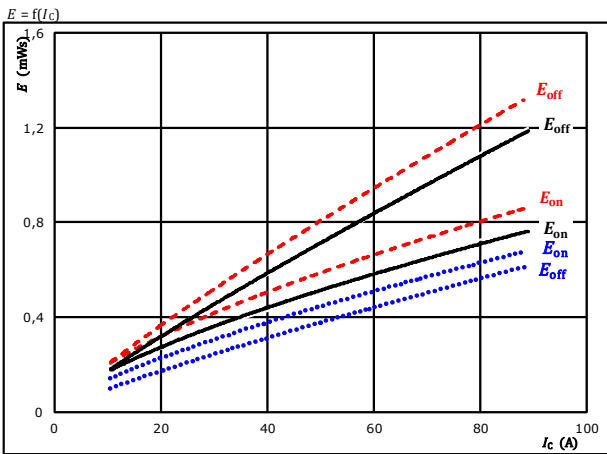


P_{rec} (100%) =	17,77	kW
E_{rec} (100%) =	0,87	mJ
t_{Erec} =	0,19	μs



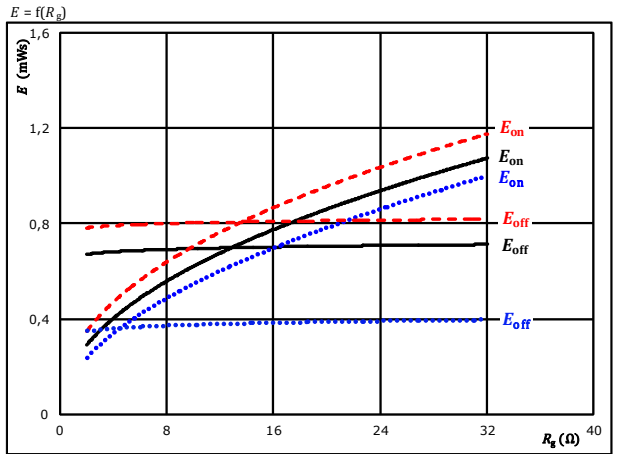
Boost Switching Characteristics

figure 1. IGBT
Typical switching energy losses as a function of collector current



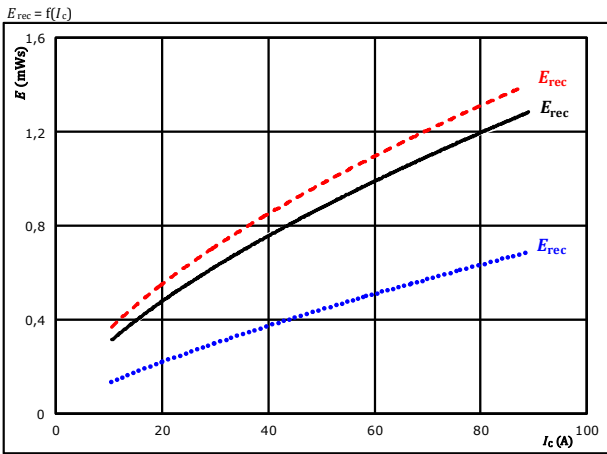
With an inductive load at
 $V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $R_{g\text{on}} = 8$ Ω
 $R_{g\text{off}} = 8$ Ω
 T_j : 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

figure 2. IGBT
Typical switching energy losses as a function of gate resistor



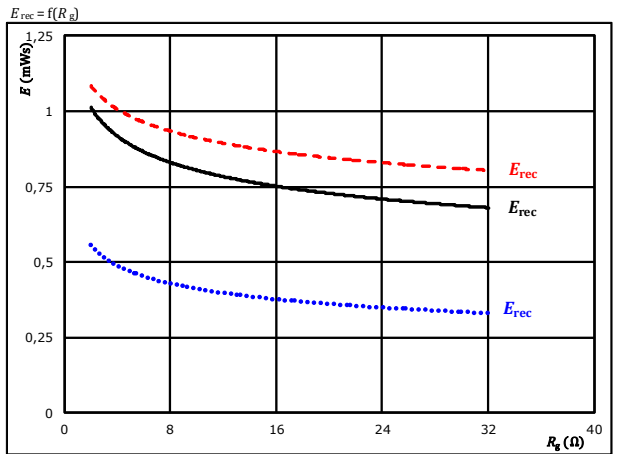
With an inductive load at
 $V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $I_C = 50$ A
 T_j : 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

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
 $R_{g\text{on}} = 8$ Ω
 T_j : 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

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
 $I_C = 50$ A
 T_j : 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

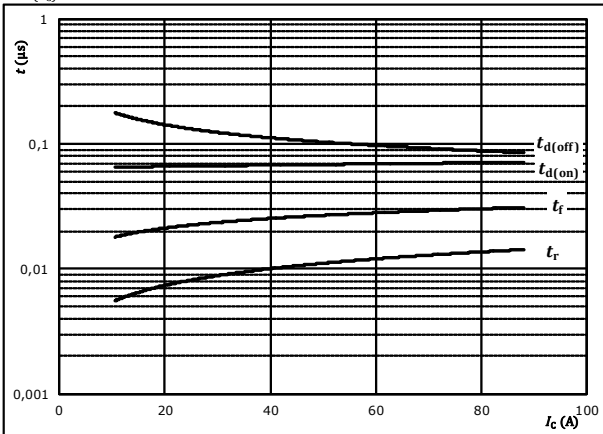


Boost Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



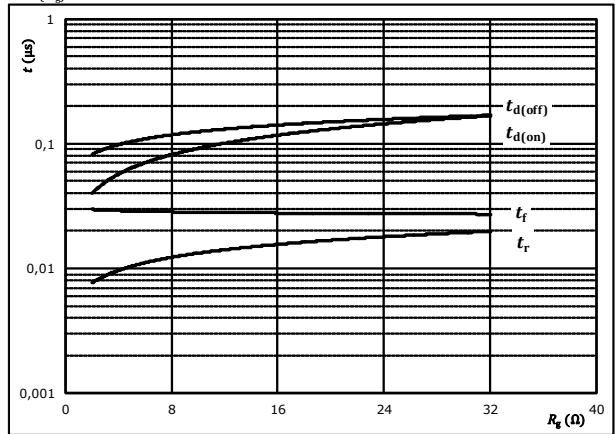
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	350	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

$$t = f(R_g)$$



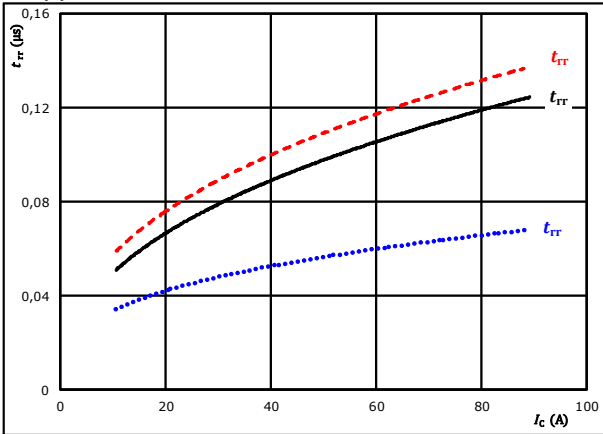
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$I_C =$	50	A

figure 7. FWD

Typical reverse recovery time as a function of collector current

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

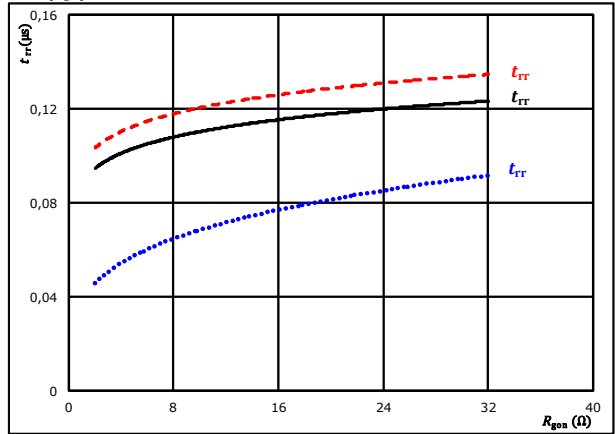


At	$V_{CE} =$	350	V	$T_j =$	25 °C
	$V_{GE} =$	±15	V		125 °C	————
	$R_{g(on)} =$	8	Ω		150 °C	-----

figure 8. FWD

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

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



At	$V_{CE} =$	350	V	$T_j =$	25 °C
	$V_{GE} =$	±15	V		125 °C	————
	$I_C =$	50	A		150 °C	-----

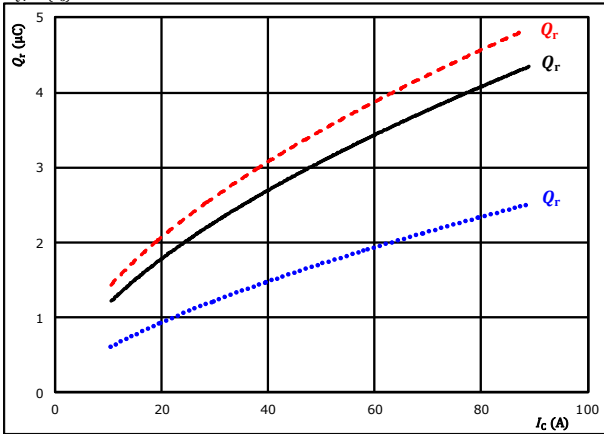


Boost Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

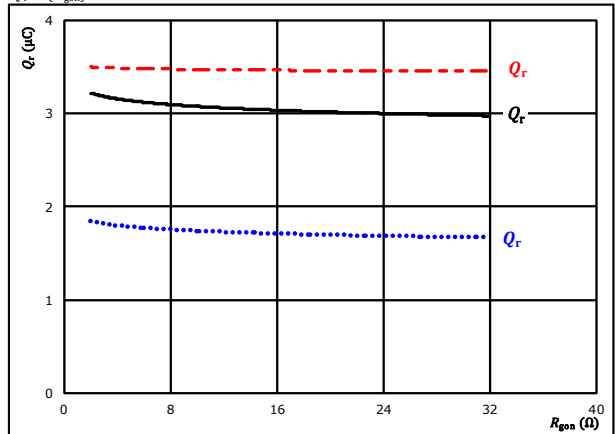


At $V_{CE} = 350$ V $T_j = 25$ °C (dotted blue)
 $V_{GE} = \pm 15$ V $T_j = 125$ °C (solid black)
 $R_{gon} = 8$ Ω $T_j = 150$ °C (dashed red)

figure 10. FWD

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

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

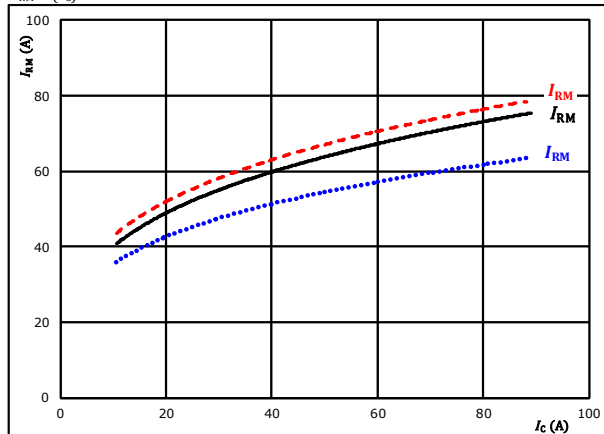


At $V_{CE} = 350$ V $T_j = 25$ °C (dotted blue)
 $V_{GE} = \pm 15$ V $T_j = 125$ °C (solid black)
 $I_c = 50$ A $T_j = 150$ °C (dashed red)

figure 11. FWD

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

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

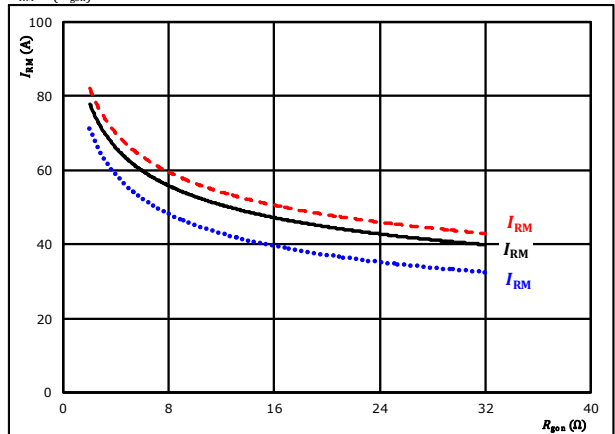


At $V_{CE} = 350$ V $T_j = 25$ °C (dotted blue)
 $V_{GE} = \pm 15$ V $T_j = 125$ °C (solid black)
 $R_{gon} = 8$ Ω $T_j = 150$ °C (dashed red)

figure 12. FWD

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

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



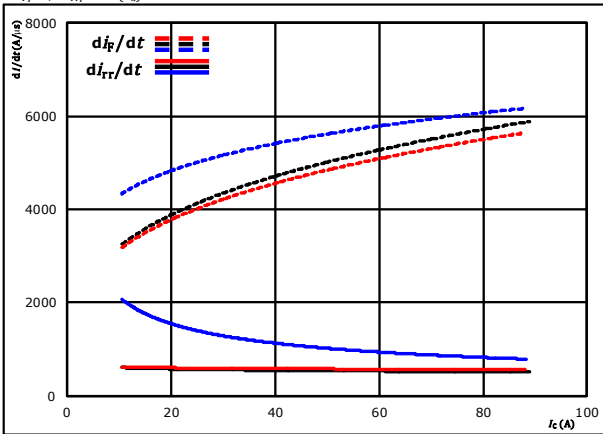
At $V_{CE} = 350$ V $T_j = 25$ °C (dotted blue)
 $V_{GE} = \pm 15$ V $T_j = 125$ °C (solid black)
 $I_c = 50$ A $T_j = 150$ °C (dashed red)



Boost Switching Characteristics

figure 13. FWD

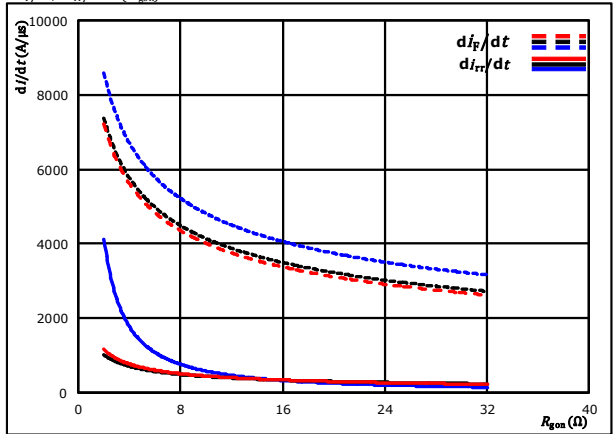
Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_F/dt, di_{rr}/dt = f(I_C)$



At $V_{CE} = 350$ V $T_j = 25$ °C (.....)
 $V_{GE} = \pm 15$ V $T_j = 125$ °C (—)
 $R_{g(on)} = 8$ Ω $T_j = 150$ °C (---)

figure 14. FWD

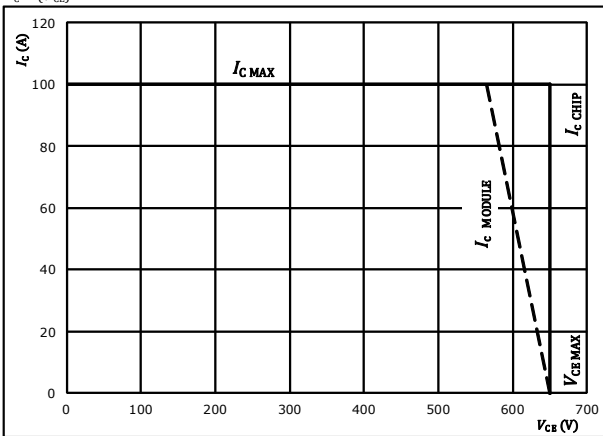
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
 $di_F/dt, di_{rr}/dt = f(R_{g(on)})$



At $V_{CE} = 350$ V $T_j = 25$ °C (.....)
 $V_{GE} = \pm 15$ V $T_j = 125$ °C (—)
 $I_C = 50$ A $T_j = 150$ °C (---)

figure 15. IGBT

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



At $T_j = 175$ °C
 $R_{g(on)} = 8$ Ω
 $R_{g(off)} = 8$ Ω



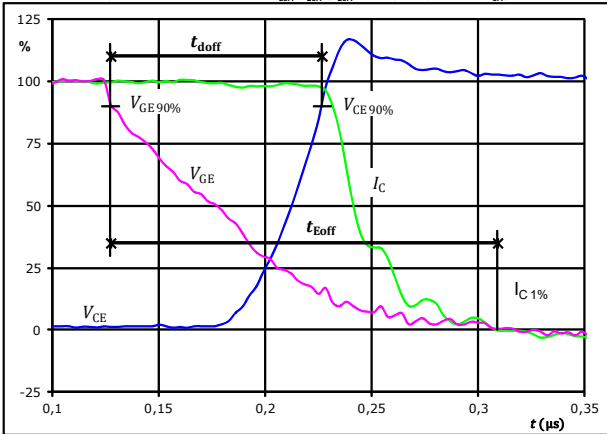
Boost Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	4 Ω
R_{goff}	=	4 Ω

figure 1. IGBT

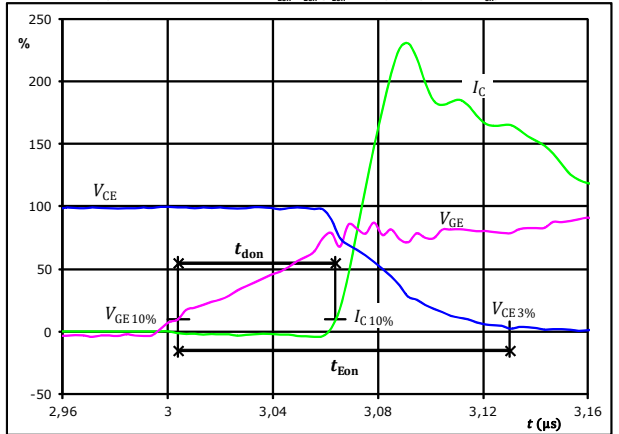
Turn-off Switching Waveforms & definition of t_{doff} , t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	50	A
$t_{doff} =$	0,099	μs
$t_{Eoff} =$	0,181	μs

figure 2. IGBT

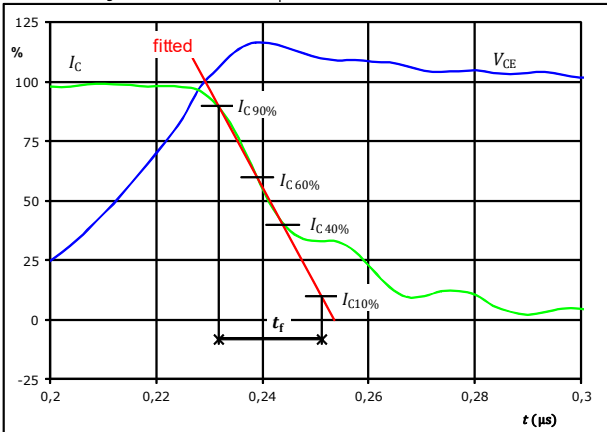
Turn-on Switching Waveforms & definition of t_{don} , t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	50	A
$t_{don} =$	0,069	μs
$t_{Eon} =$	0,126	μs

figure 3. IGBT

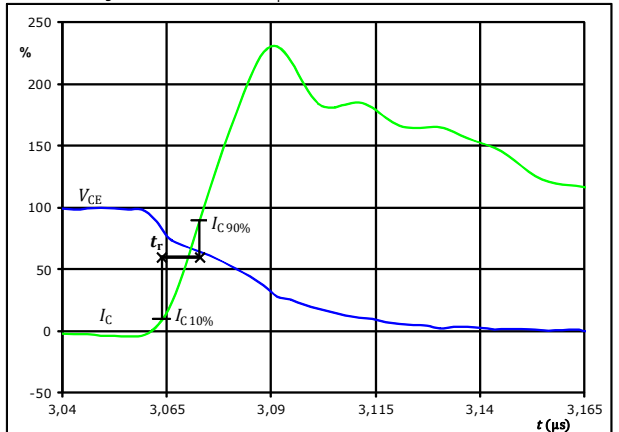
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%) =$	350	V
$I_C(100\%) =$	50	A
$t_f =$	0,024	μs

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

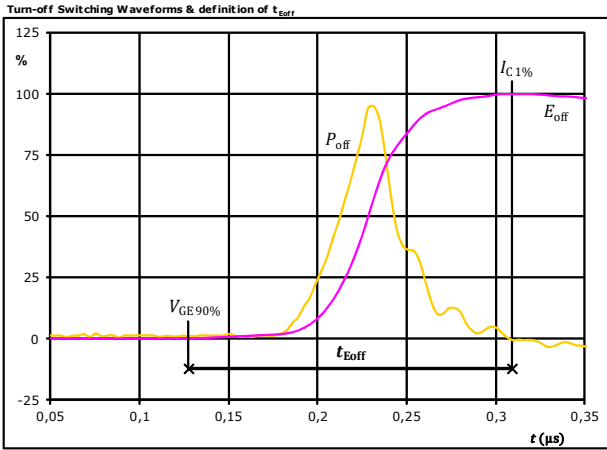


$V_C(100\%) =$	350	V
$I_C(100\%) =$	50	A
$t_r =$	0,010	μs



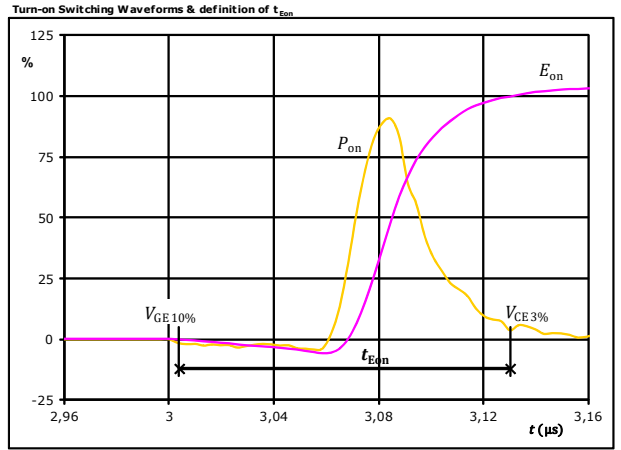
Boost Switching Characteristics

figure 5. IGBT



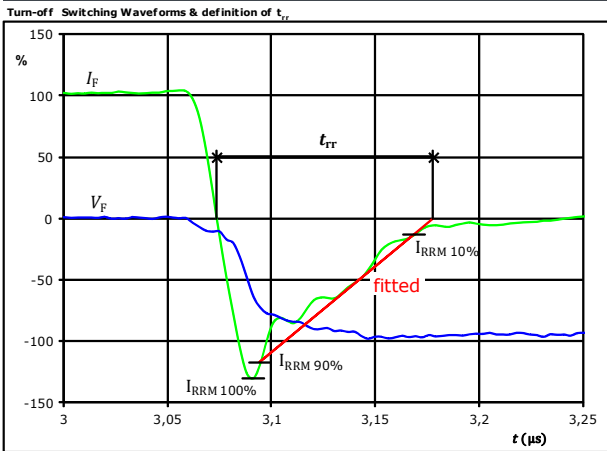
$P_{off}(100\%) = 17,34$ kW
 $E_{off}(100\%) = 0,69$ mJ
 $t_{Eoff} = 0,18$ µs

figure 6. IGBT



$P_{on}(100\%) = 17,34$ kW
 $E_{on}(100\%) = 0,49$ mJ
 $t_{Eon} = 0,13$ µs

figure 7. FWD

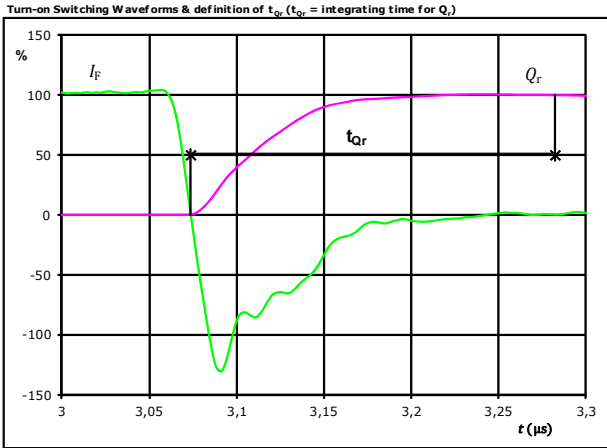


$V_F(100\%) = 350$ V
 $I_F(100\%) = 50$ A
 $I_{RRM}(100\%) = -62$ A
 $t_{tr} = 0,104$ µs



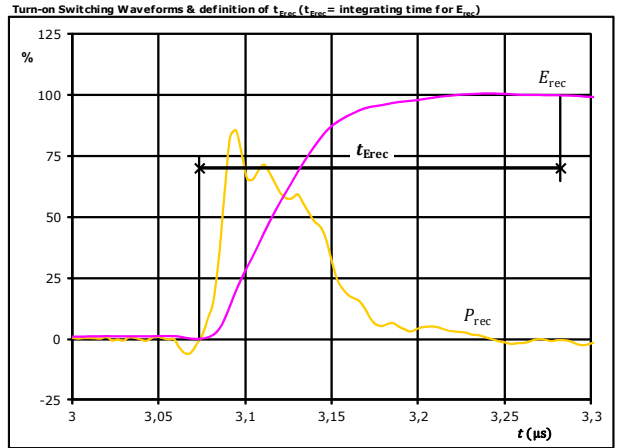
Boost Switching Characteristics

figure 8. FWD



I_F (100%) =	50	A
Q_r (100%) =	3,09	μC
t_{Qr} =	0,21	μs



figure 9. FWD



P_{rec} (100%) =	17,34	kW
E_{rec} (100%) =	0,87	mJ
t_{Erec} =	0,21	μs

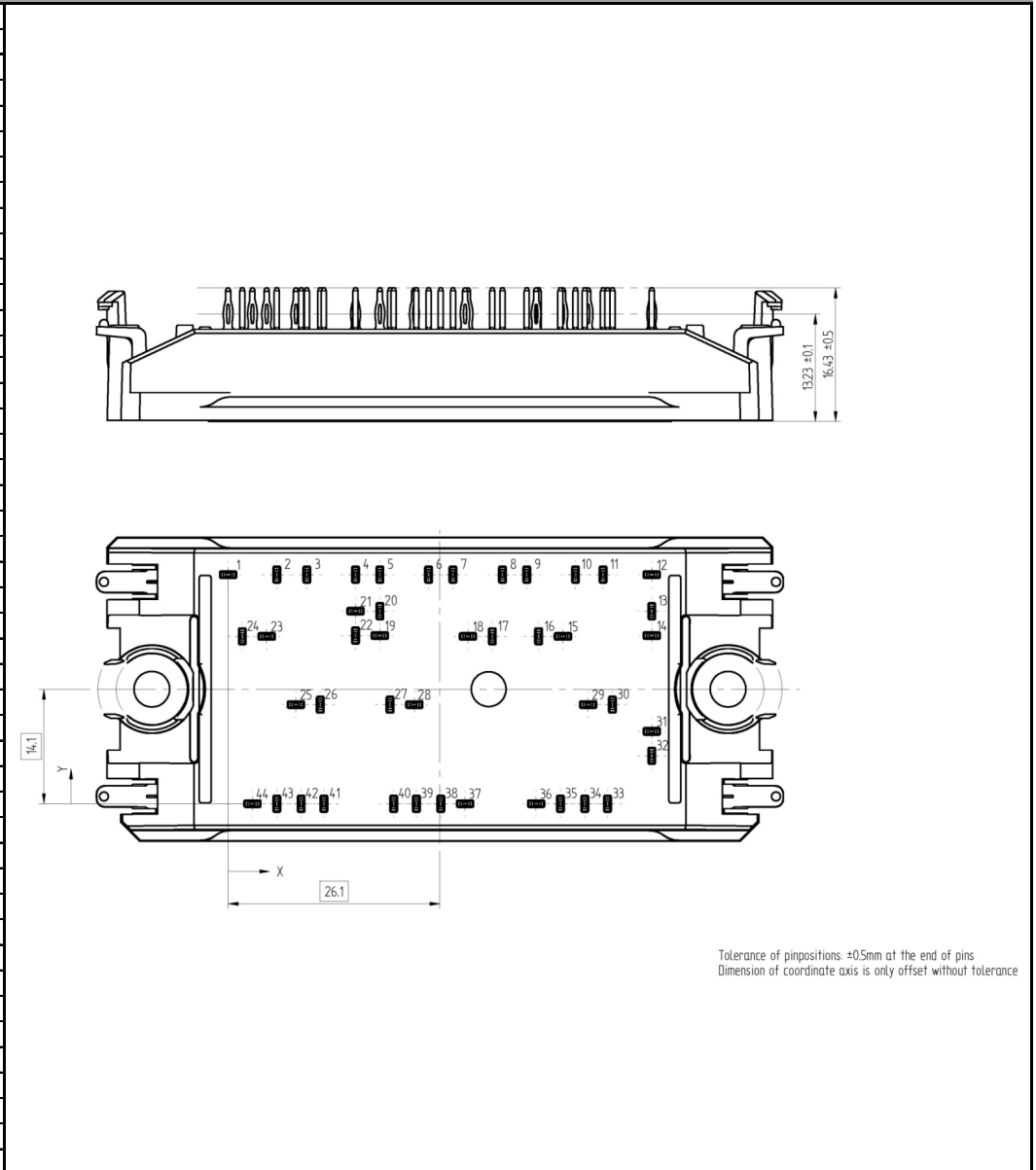


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Ordering Code & Marking						
Version			Ordering Code			
without thermal paste 12 mm housing with press-fit pins			10-PH07N3A050S5-M896F98T			
NN-NNNNNNNNNNNN TTTTWW WWYY UL VIN LLLL SSSS						
Text	Name		Date code	UL & VIN	Lot	Serial
	NN-NNNNNNNNNNNN-TTTTWW		WWYY	UL VIN	LLLL	SSSS
Datamatrix	Type&Ver	Lot number	Serial	Date code		
	TTTTWW	LLLL	SSSS	WWYY		

Outline

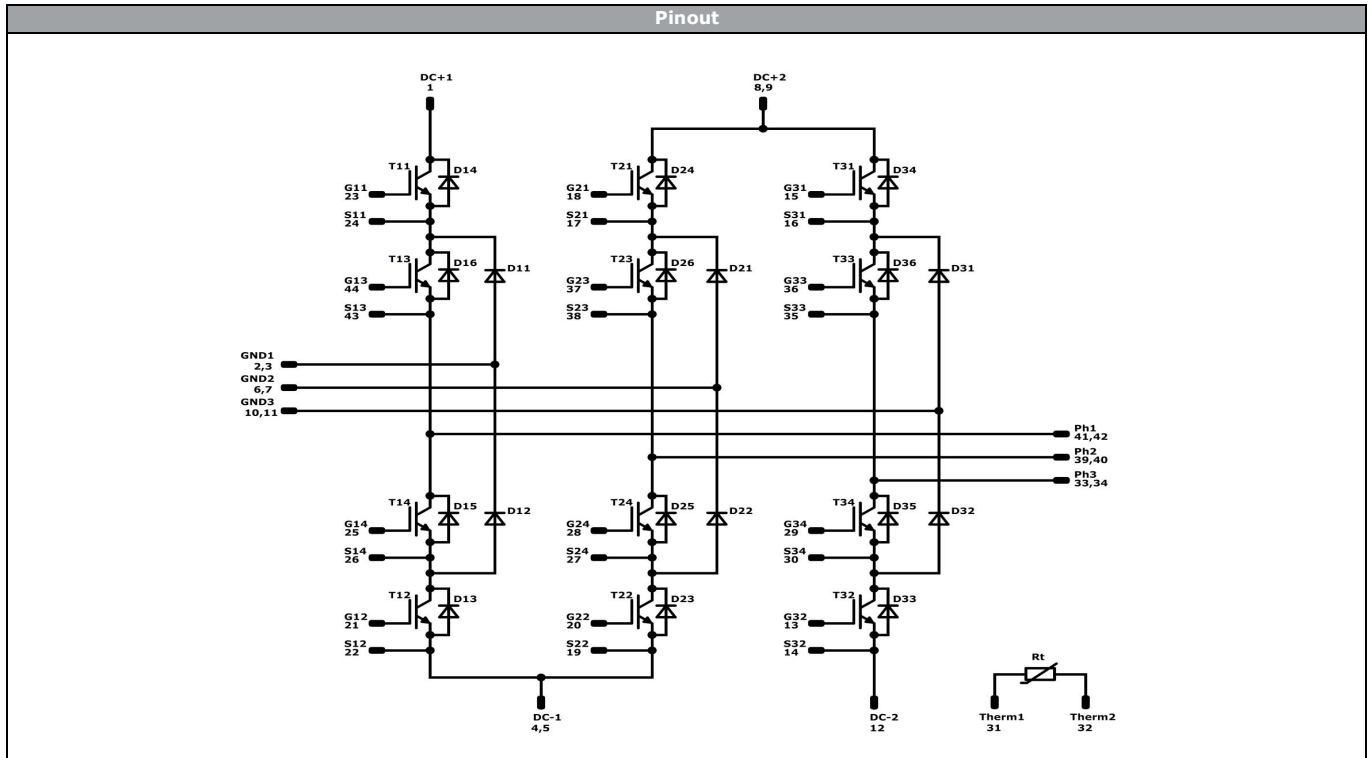
Pin Table			
Hole	X	Y	Function
1	0	28,2	DC+1
2	6	28,2	GND1
3	9,7	28,2	GND1
4	15,7	28,2	DC-1
5	18,7	28,2	DC-1
6	24,7	28,2	GND2
7	27,7	28,2	GND2
8	33,8	28,2	DC+2
9	36,8	28,2	DC+2
10	42,8	28,2	GND3
11	46,2	28,2	GND3
12	52,2	28,2	DC-2
13	52,2	23,7	G32
14	52,2	20,7	S32
15	41,25	20,6	G31
16	38,25	20,6	S31
17	32,55	20,6	S21
18	29,55	20,6	G21
19	18,7	20,7	S22
20	18,7	23,7	G22
21	15,7	23,7	G12
22	15,7	20,7	S12
23	4,75	20,6	G11
24	1,75	20,6	S11
25	8,35	12,2	G14
26	11,35	12,2	S14
27	19,95	12,2	S24
28	22,95	12,2	G24
29	44,35	12,2	G34
30	47,35	12,2	S34
31	52,2	8,9	Therm1
32	52,2	5,9	Therm2
33	46,75	0	Ph3
34	43,95	0	Ph3
35	40,95	0	S33
36	37,95	0	G33
37	29,2	0	G23
38	26,2	0	S23
39	23,2	0	Ph2
40	20,4	0	Ph2
41	11,8	0	Ph1
42	9	0	Ph1
43	6	0	S13
44	3	0	G13



Tolerance of pinpositions: ±0.5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance



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Identification						
ID	Component	Voltage	Current	Function	Comment	
T11, T21, T31, T12, T22, T32	IGBT	650 V	50 A	Buck Switch		
D11, D21, D31, D12, D22, D32	FWD	650 V	50 A	Buck Diode		
T13, T23, T33, T14, T24, T34	IGBT	650 V	50 A	Boost Switch		
D13, D23, D33, D14, D24, D34	FWD	650 V	50 A	Boost Diode		
D15, D16, D25, D26, D35, D36	Inverse Diode	650 V	50 A	Boost Sw.Inv.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</i> 1 packages see vincotech.com website.

Package data
Package data for <i>flow</i> 1 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-PH07N3A050S5-M896F98T-D2-14	16 Jan. 2018	Schematic changed, Boost Diode / Boost Sw.Inv. Diode Rth values changed, Added Boost Switch characteristic values and Graphs	1, 5, 6, 7, 23-29

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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.