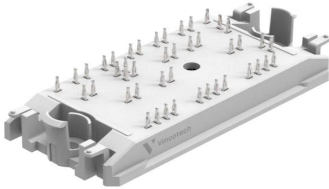
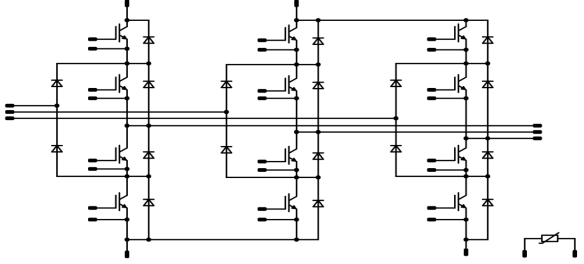




Vincotech

<i>flow 3xNPC 1</i>	1200 V / 30 A
<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; 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; 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; margin: 0;">Types</p> <ul style="list-style-type: none"> 10-PH07N3A030S5-M894F98T </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;">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		30	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	90	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	61	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		30	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	57	W
Maximum junction temperature	T_{jmax}		175	°C
Boost Switch				
Collector-emitter voltage	V_{CES}		650	V
Collector current	I_C		30	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	90	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	61	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		30	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	57	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		30	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	57	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_{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 Switch

Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0003	25	3,2	4	4,8	V
Collector-emitter saturation voltage	V_{CESat}		15		30	25 125 150		1,35 1,54 1,57	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}							1800		pF
Output capacitance	C_{oes}	$f = 1$ Mhz	0	25		25		55		
Reverse transfer capacitance	C_{res}							7		
Gate charge	Q_g		15	520	30	25		70		nC

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,55		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		70 70 70		ns
Rise time	t_r	$R_{goff} = 16$ Ω $R_{gon} = 16$ Ω				25 125 150		8 9 10		
Turn-off delay time	$t_{d(off)}$		±15	350	30	25 125 150		86 104 107		
Fall time	t_f					25 125 150		13 15 21		
Turn-on energy (per pulse)	E_{on}	$Q_{t-FWD} = 1,1$ μC $Q_{t-FWD} = 1,9$ μC $Q_{t-FWD} = 2,1$ μC				25 125 150		0,397 0,505 0,639		
Turn-off energy (per pulse)	E_{off}					25 125 150		0,224 0,363 0,374		



Vincotech

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				30	25 125 150		1,52 1,46 1,44	1,92	V
Reverse leakage current	I_R			650		25			1,6	μA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						1,68		K/W
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Dynamic

Peak recovery current	I_{RRM}					25 125 150		48 63 61		A
Reverse recovery time	t_{rr}					25 125 150		52 66 74		ns
Recovered charge	Q_r	$di/dt = 5071 \text{ A/}\mu\text{s}$ $di/dt = 4912 \text{ A/}\mu\text{s}$ $di/dt = 4100 \text{ A/}\mu\text{s}$	±15	350	30	25 125 150		1,06 1,91 2,10		μC
Reverse recovered energy	E_{rec}					25 125 150		0,220 0,437 0,508		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		3847 3784 3030		A/μs



Vincotech

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	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,0003	25	3,2	4	4,8	V
Collector-emitter saturation voltage	V_{CESat}		15		30	25 125 150		1,35 1,54 1,57	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}							1800		pF
Output capacitance	C_{oes}	$f = 1$ Mhz	0	25		25		55		
Reverse transfer capacitance	C_{res}							7		
Gate charge	Q_g		15	520	30	25		70		nC

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,55		K/W
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Dynamic

Turn-on delay time	$t_{d(on)}$					25 125 150		70 69 64		ns
Rise time	t_r	$R_{goff} = 16$ Ω $R_{gon} = 16$ Ω				25 125 150		8 10 11		
Turn-off delay time	$t_{d(off)}$		±15	350	30	25 125 150		91 109 115		
Fall time	t_f					25 125 150		14 27 45		
Turn-on energy (per pulse)	E_{on}	$Q_{tFWD} = 1$ μC $Q_{tFWD} = 1,7$ μC $Q_{tFWD} = 2$ μC				25 125 150		0,293 0,364 0,393		
Turn-off energy (per pulse)	E_{off}					25 125 150		0,287 0,449 0,504		



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				30	25 125 150		1,52 1,46 1,44	1,92	V
Reverse leakage current	I_R			650		25			1,6	μA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,68		K/W
-------------------------------------	---------------	------------------------------------	--	--	--	--	--	------	--	-----

Dynamic

Peak recovery current	I_{RRM}					25 125 150		27 36 39		A
Reverse recovery time	t_{rr}					25 125 150		61 95 104		ns
Recovered charge	Q_r	$di/dt = 4111$ A/μs $di/dt = 3494$ A/μs $di/dt = 3415$ A/μs	±15	350	30	25 125 150		0,968 1,73 2,00		μC
Reverse recovered energy	E_{rec}					25 125 150		0,249 0,460 0,540		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		287 267 272		A/μs

Boost Sw.Inv.Diode

Static

Forward voltage	V_F				30	25 125 150		1,52 1,46 1,44	1,92	V
Reverse leakage current	I_R			650		25			1,6	μA

Thermal

Thermal resistance junction to sink	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,68		K/W
-------------------------------------	---------------	------------------------------------	--	--	--	--	--	------	--	-----



Vincotech

Characteristic Values

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

Thermistor

Rated resistance	R					25		22		k Ω
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	

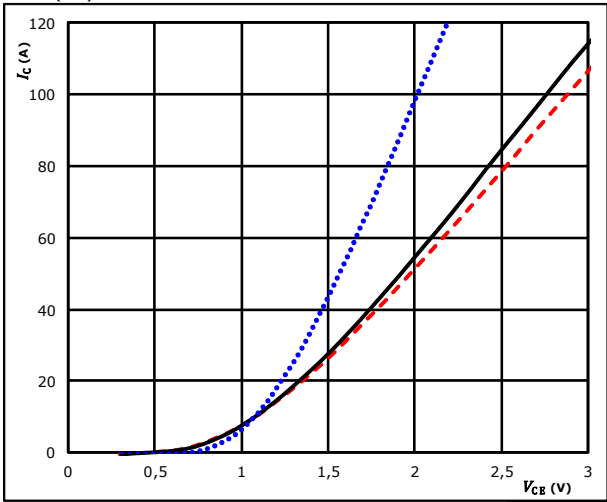


Buck Switch Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

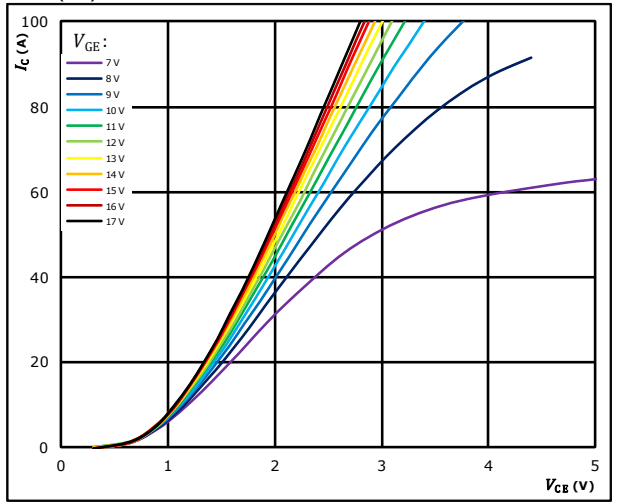


$t_p = 250 \mu s$ $T_j: 25 \text{ }^\circ C$
 $V_{GE} = 15 \text{ V}$ $T_j: 125 \text{ }^\circ C$ ———
 $T_j: 150 \text{ }^\circ C$ - - - - -

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

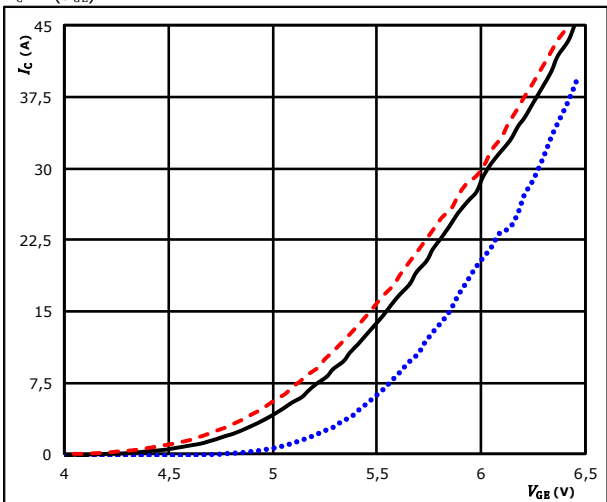


$t_p = 250 \mu s$
 $T_j = 150 \text{ }^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

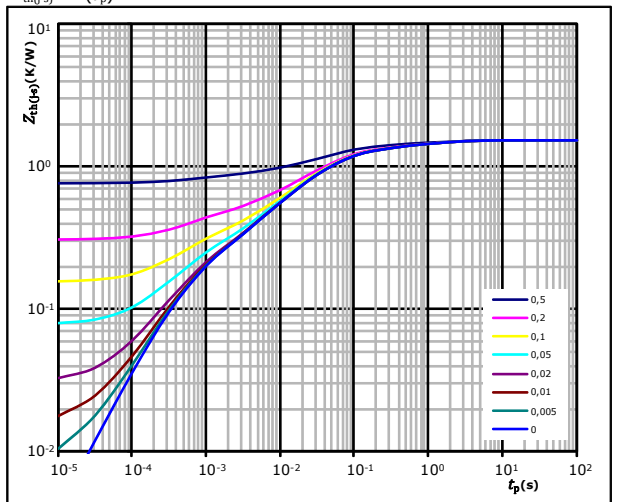


$t_p = 100 \mu s$ $T_j: 25 \text{ }^\circ C$
 $V_{CE} = 10 \text{ V}$ $T_j: 125 \text{ }^\circ C$ ———
 $T_j: 150 \text{ }^\circ C$ - - - - -

figure 4. IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$
 $R_{th(j-s)} = 1,55 \text{ K/W}$

IGBT thermal model values

R (K/W)	τ (s)
1,59E-01	1,52E+00
1,99E-01	2,30E-01
6,35E-01	4,33E-02
2,87E-01	1,21E-02
1,19E-01	2,99E-03
1,51E-01	4,74E-04

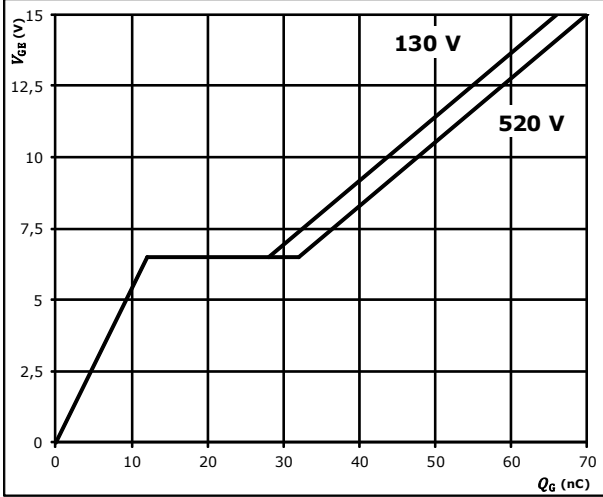


Buck Switch Characteristics

figure 5. IGBT

Gate voltage vs gate charge

$V_{GE} = f(Q_G)$

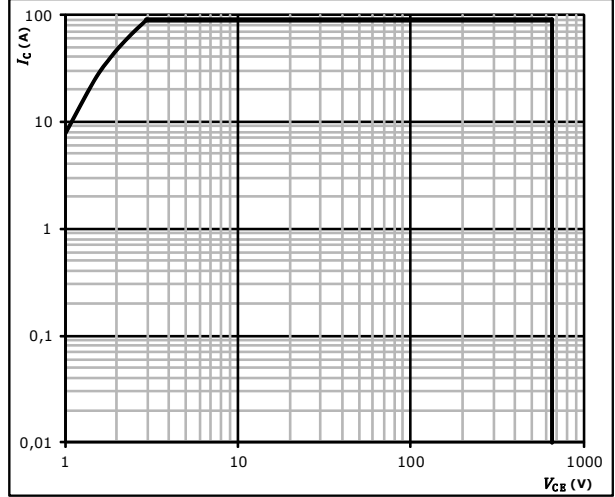


$I_C = 30$ A

figure 6. IGBT

Safe operating area

$I_C = f(V_{CE})$



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

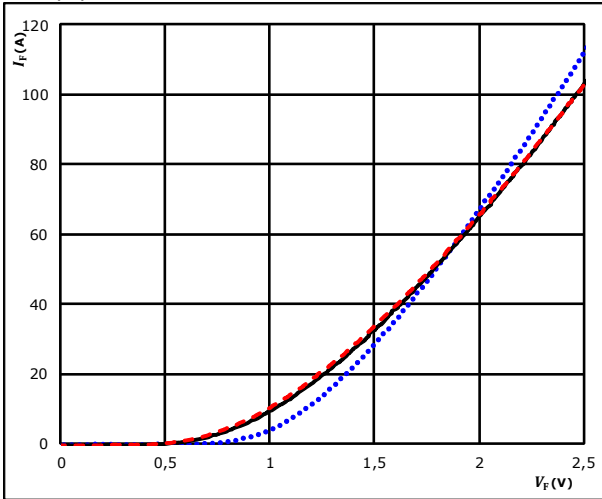


Buck Diode Characteristics

figure 1. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

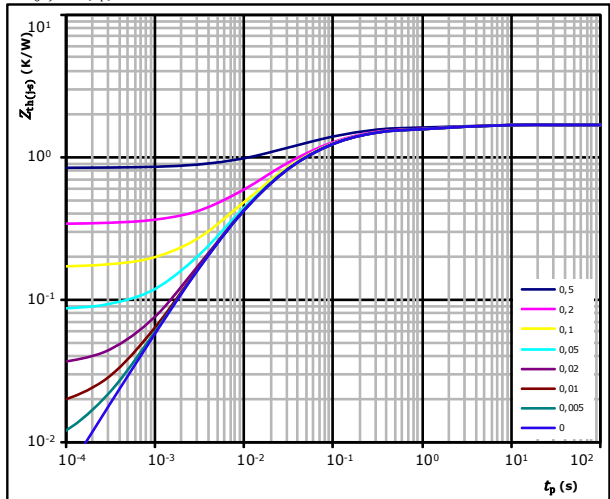


$t_p = 250 \mu s$
 T_j : 25 °C (dotted blue), 125 °C (solid black), 150 °C (dashed red)

figure 2. FWD

Transient thermal impedance as a function of pulse width

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



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

$$R_{th(j-s)} = 1,68 \text{ K/W}$$

FWD thermal model values

R (K/W)	τ (s)
1,73E-01	2,27E+00
6,00E-01	1,18E-01
5,23E-01	3,14E-02
2,23E-01	1,59E-02
1,59E-01	6,69E-03

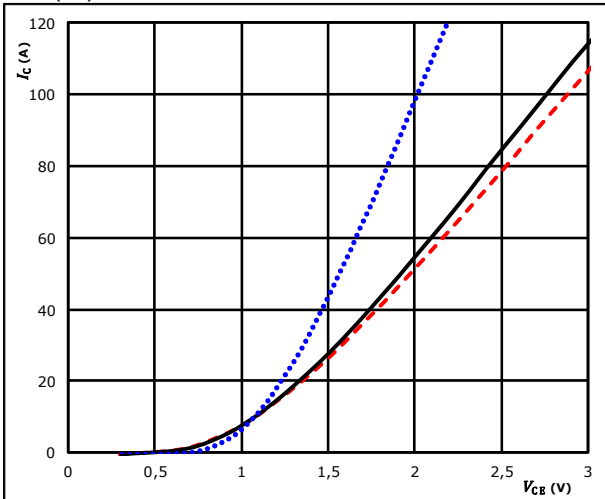


Boost Switch Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

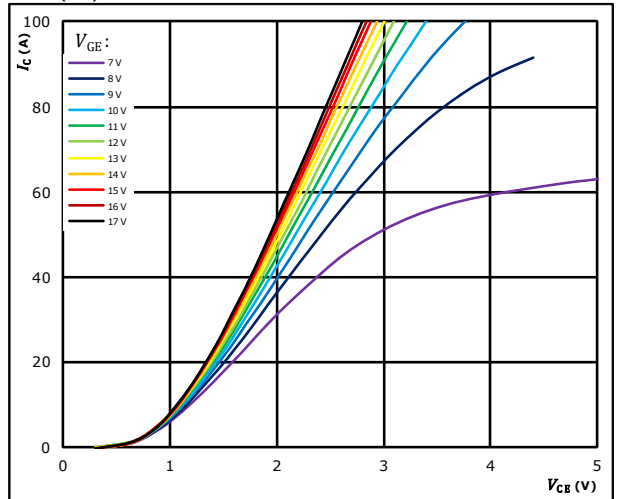


$t_p = 250 \mu s$ $T_j: 25 \text{ }^\circ C$
 $V_{GE} = 15 \text{ V}$ $T_j: 125 \text{ }^\circ C$ ———
 $T_j: 150 \text{ }^\circ C$ - - - - -

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

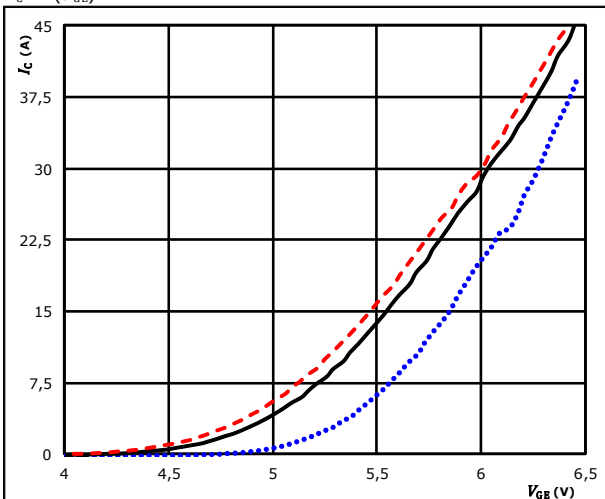


$t_p = 250 \mu s$
 $T_j = 150 \text{ }^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

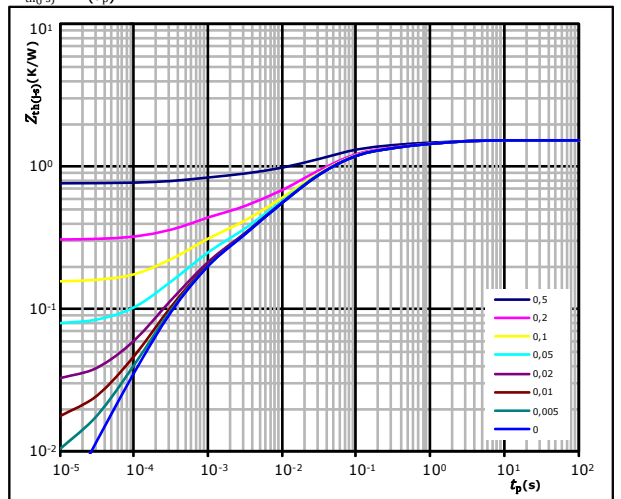


$t_p = 100 \mu s$ $T_j: 25 \text{ }^\circ C$
 $V_{CE} = 10 \text{ V}$ $T_j: 125 \text{ }^\circ C$ ———
 $T_j: 150 \text{ }^\circ C$ - - - - -

figure 4. IGBT

Transient thermal impedance as function of pulse duration

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



$D = t_p / T$
 $R_{th(j-s)} = 1,55 \text{ K/W}$

IGBT thermal model values

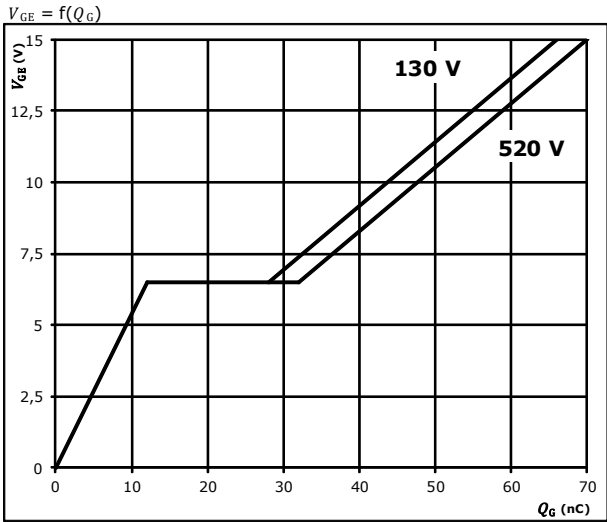
R (K/W)	τ (s)
1,59E-01	1,52E+00
1,99E-01	2,30E-01
6,35E-01	4,33E-02
2,87E-01	1,21E-02
1,19E-01	2,99E-03
1,51E-01	4,74E-04



Boost Switch Characteristics

figure 5. IGBT

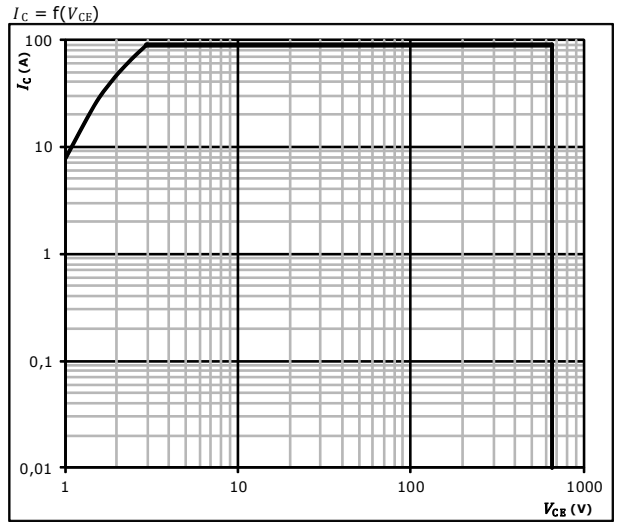
Gate voltage vs gate charge



$I_C = 30$ A

figure 6. IGBT

Safe operating area



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

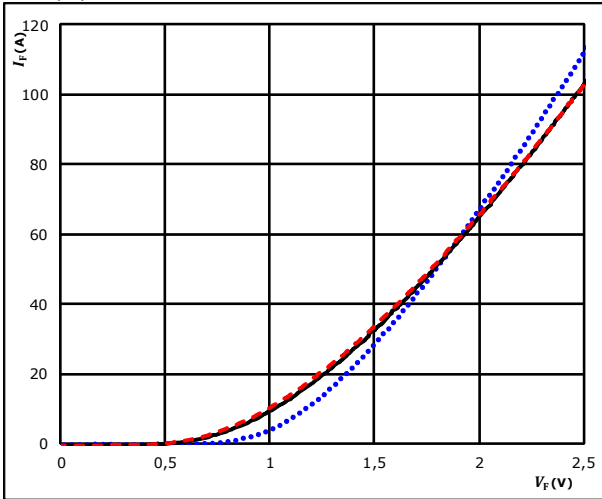


Boost Diode Characteristics

figure 1. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

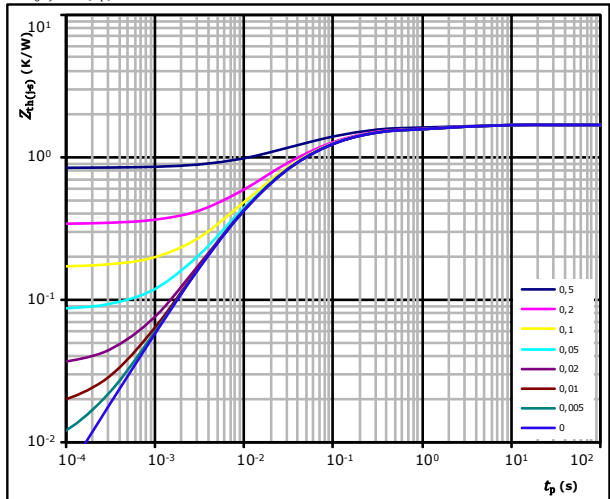


$t_p = 250 \mu s$
 T_j : 25 °C (dotted blue), 125 °C (solid black), 150 °C (dashed red)

figure 2. FWD

Transient thermal impedance as a function of pulse width

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



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

$$R_{th(j-s)} = 1,68 \text{ K/W}$$

FWD thermal model values

R (K/W)	τ (s)
1,73E-01	2,27E+00
6,00E-01	1,18E-01
5,23E-01	3,14E-02
2,23E-01	1,59E-02
1,59E-01	6,69E-03

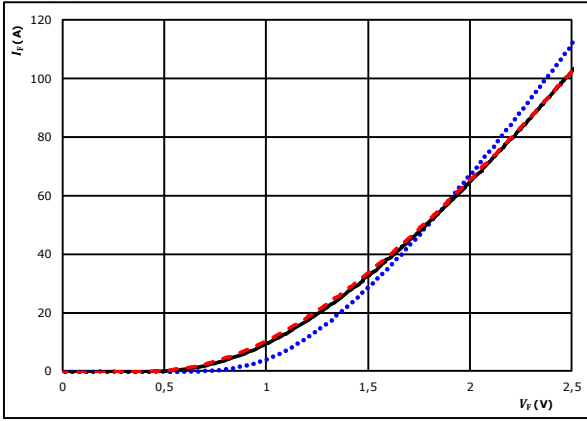


Boost Sw.Inv.Diode Characteristics

figure 1. Inverse Diode

Typical forward characteristics

$$I_F = f(V_F)$$

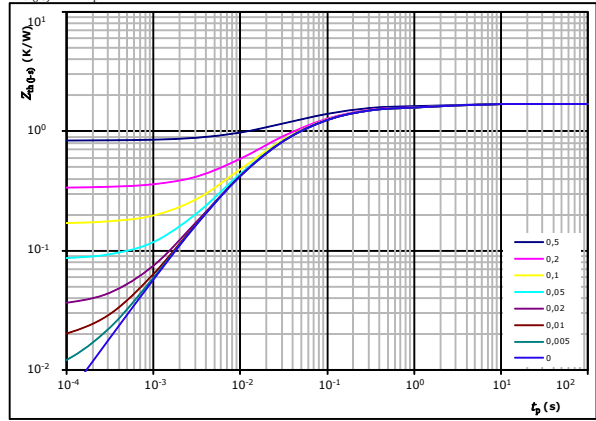


$t_p = 250 \mu s$
 T_j : 25 °C (blue dotted), 125 °C (black solid), 150 °C (red dashed)

figure 2. Inverse Diode

Transient thermal impedance as a function of pulse width

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



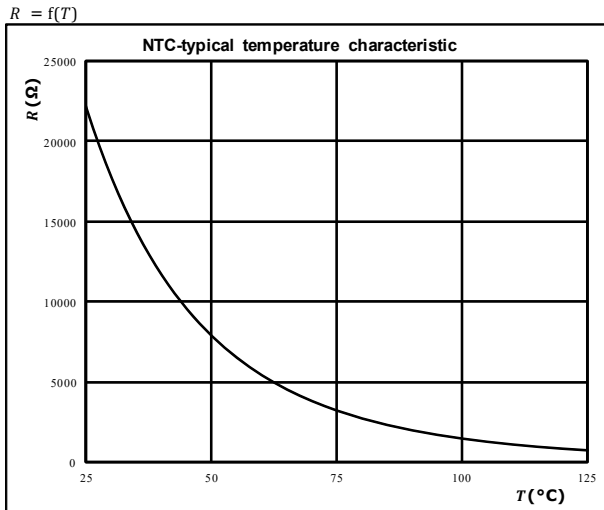
$D = t_p / T$
 $R_{th(j-s)} = 1,68 \text{ K/W}$
 Inverse Diode thermal model values

R (K/W)	τ (s)
1,73E-01	2,27E+00
6,00E-01	1,18E-01
5,23E-01	3,14E-02
2,23E-01	1,59E-02
1,59E-01	6,69E-03



Thermistor Characteristics

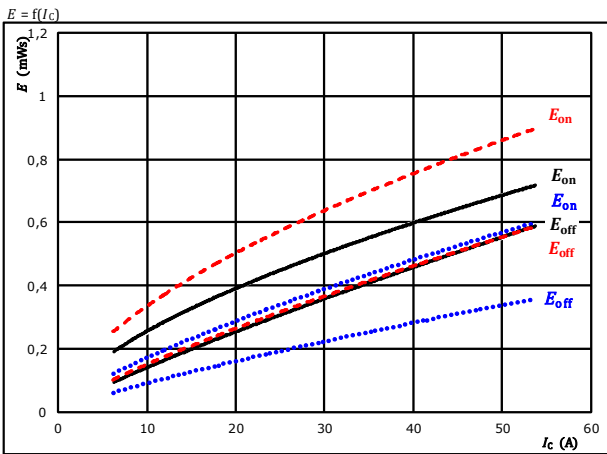
figure 1. Thermistor
Typical NTC characteristic as a function of temperature





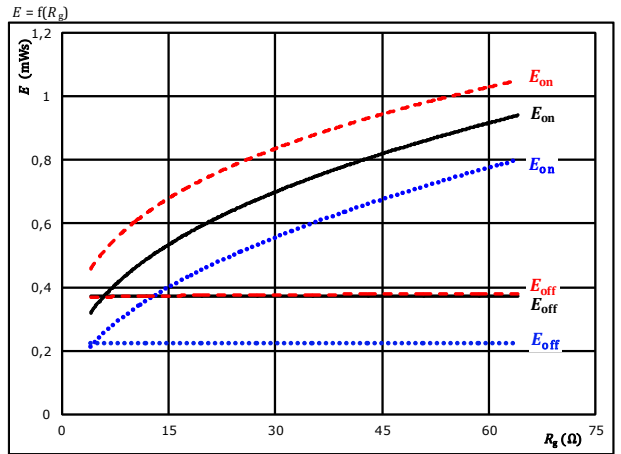
Buck Switching Characteristics

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



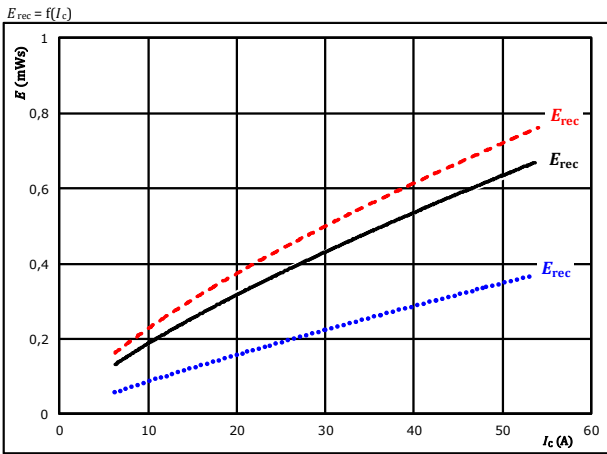
With an inductive load at
 $V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $R_{g\text{on}} = 16$ Ω
 $R_{g\text{off}} = 16$ Ω
 T_j : 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

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



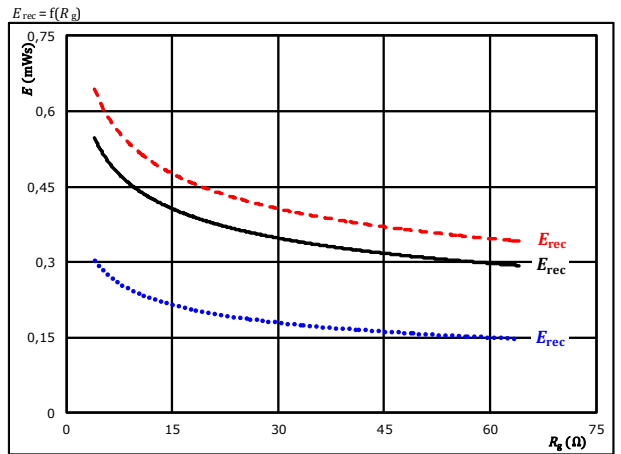
With an inductive load at
 $V_{CE} = 350$ V
 $V_{GE} = \pm 15$ V
 $I_C = 30$ A
 T_j : 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

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
 $R_{g\text{on}} = 16$ 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
 $I_C = 30$ A
 T_j : 25 °C (dotted), 125 °C (solid), 150 °C (dashed)

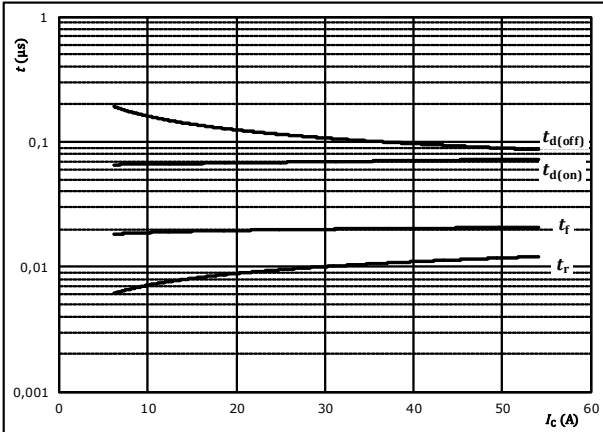


Buck Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$$t = f(I_c)$$



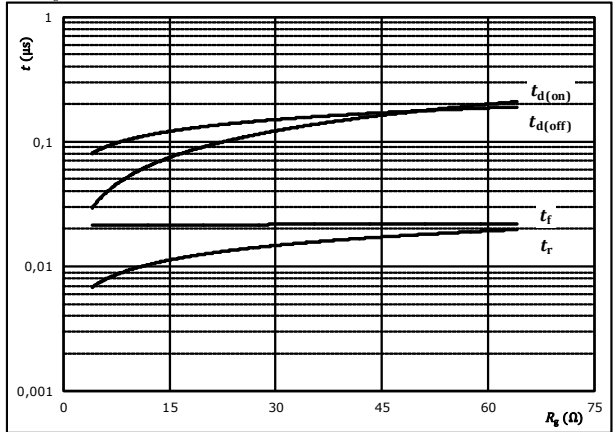
With an inductive load at

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

figure 6. IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



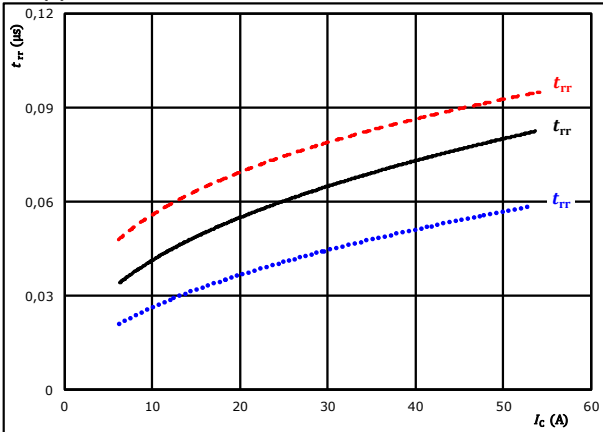
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$I_c =$	30	A

figure 7. FWD

Typical reverse recovery time as a function of collector current

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

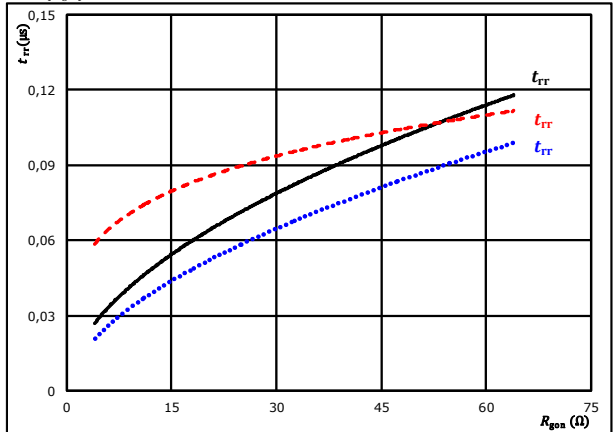


At	$V_{CE} =$	350	V	$T_j =$	25 °C
	$V_{GE} =$	±15	V		125 °C	————
	$R_{g(on)} =$	16	Ω		150 °C	-----

figure 8. FWD

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

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



At	$V_{CE} =$	350	V	$T_j =$	25 °C
	$V_{GE} =$	±15	V		125 °C	————
	$I_c =$	30	A		150 °C	-----

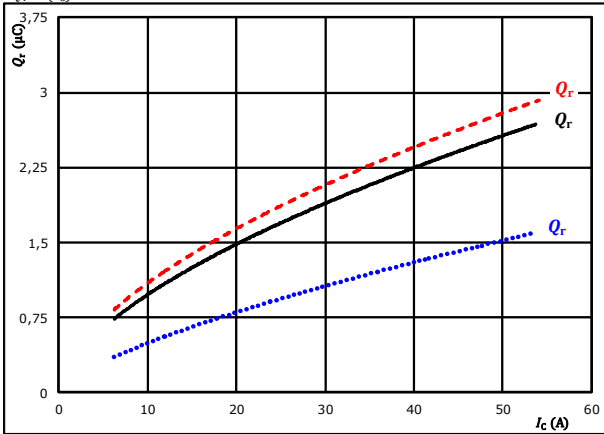


Buck Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

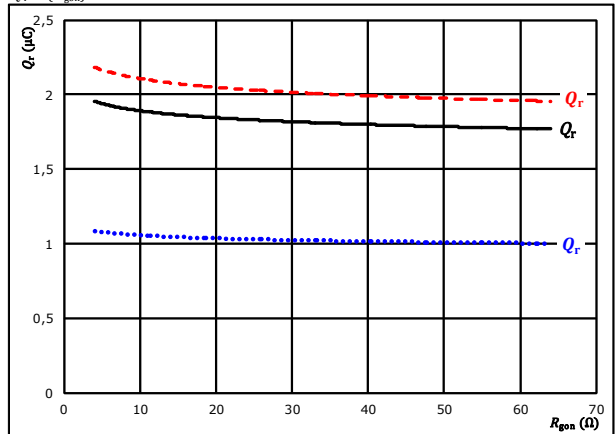


At $V_{CE} = 350$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C ———
 $R_{gon} = 16$ Ω $T_j = 150$ °C - - - -

figure 10. FWD

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

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

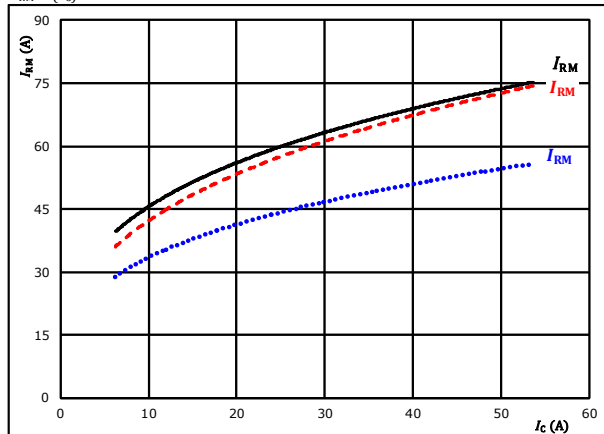


At $V_{CE} = 350$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C ———
 $I_c = 30$ A $T_j = 150$ °C - - - -

figure 11. FWD

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

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

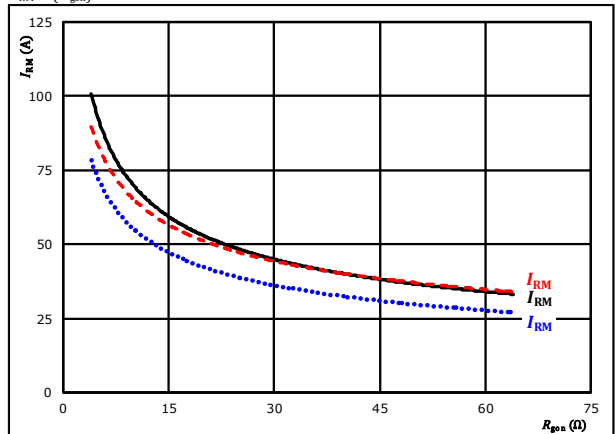


At $V_{CE} = 350$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C ———
 $R_{gon} = 16$ Ω $T_j = 150$ °C - - - -

figure 12. FWD

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

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



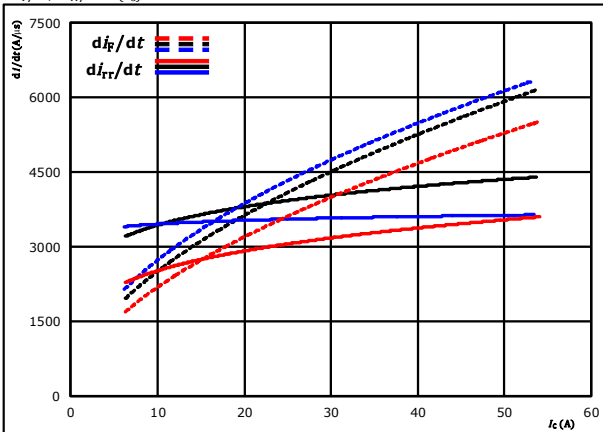
At $V_{CE} = 350$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C ———
 $I_c = 30$ A $T_j = 150$ °C - - - -



Buck Switching Characteristics

figure 13. FWD

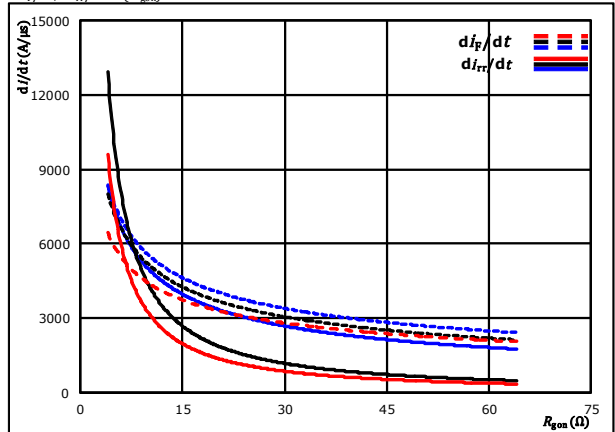
Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_f/dt, di_{rr}/dt = f(I_c)$



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

figure 14. FWD

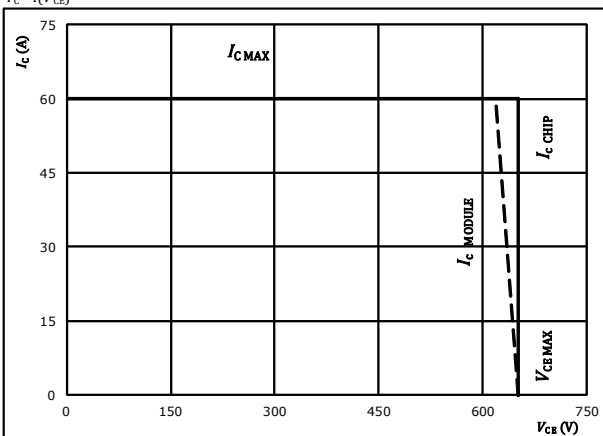
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
 $di_f/dt, di_{rr}/dt = f(R_{g(on)})$



At $V_{CE} = 350$ V $T_j = 25$ °C
 $V_{GE} = \pm 15$ V $T_j = 125$ °C ———
 $I_c = 30$ A $T_j = 150$ °C - - - - -

figure 15. IGBT

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



At $T_j = 175$ °C
 $R_{g(on)} = 16$ Ω
 $R_{g(off)} = 16$ Ω



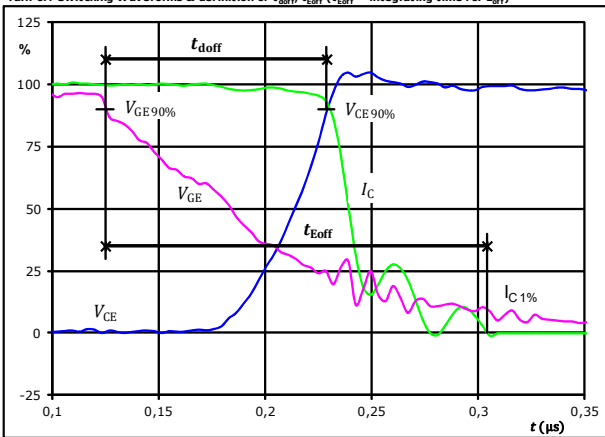
Buck Switching Definitions

General conditions

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

figure 1. IGBT

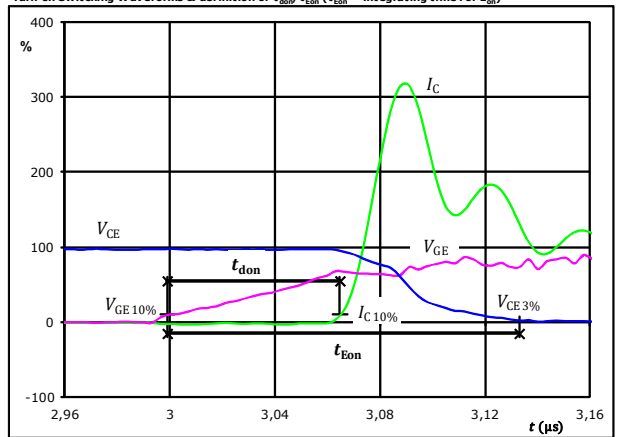
Turn-off Switching Waveforms & definition of t_{doff} , t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	30	A
$t_{doff} =$	0,104	μs
$t_{Eoff} =$	0,179	μs

figure 2. IGBT

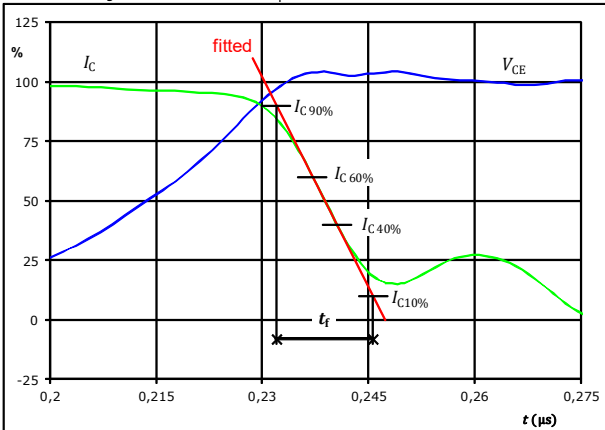
Turn-on Switching Waveforms & definition of t_{don} , t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	30	A
$t_{don} =$	0,070	μs
$t_{Eon} =$	0,134	μs

figure 3. IGBT

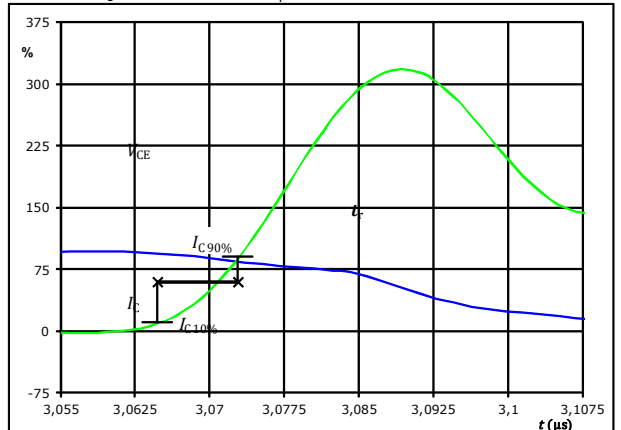
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%) =$	350	V
$I_C(100\%) =$	30	A
$t_f =$	0,015	μs

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r



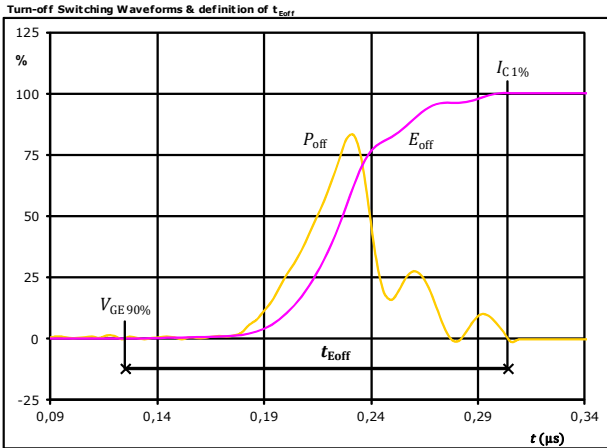
$V_C(100\%) =$	350	V
$I_C(100\%) =$	30	A
$t_r =$	0,009	μs



Vincotech

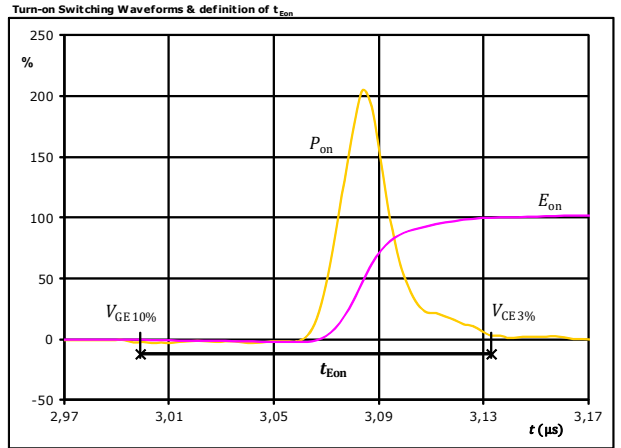
Buck Switching Characteristics

figure 5. IGBT



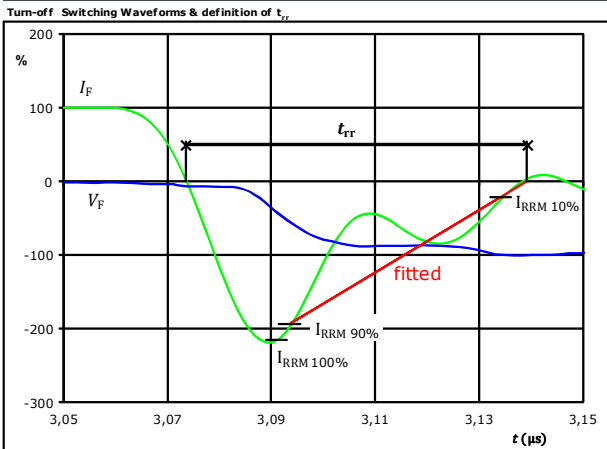
$P_{off}(100\%) =$	10,57	kW
$E_{off}(100\%) =$	0,36	mJ
$t_{Eoff} =$	0,18	μs

figure 6. IGBT



$P_{on}(100\%) =$	10,57	kW
$E_{on}(100\%) =$	0,50	mJ
$t_{Eon} =$	0,13	μs

figure 7. FWD

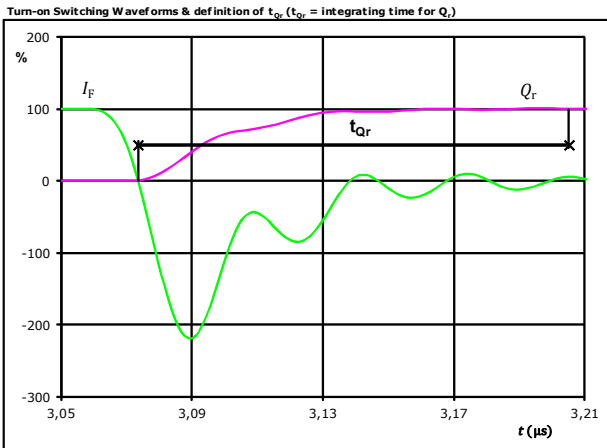


$V_F(100\%) =$	350	V
$I_F(100\%) =$	30	A
$I_{RRM}(100\%) =$	-63	A
$t_{tr} =$	0,066	μs



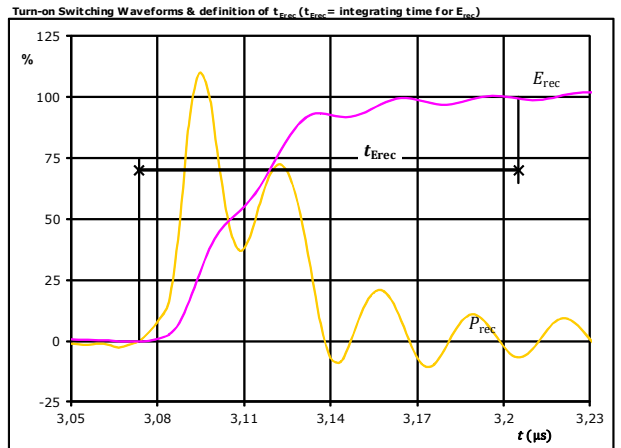
Buck Switching Characteristics

figure 8. FWD



I_F (100%) =	30	A
Q_r (100%) =	1,91	μC
t_{Qr} =	0,13	μs

figure 9. FWD



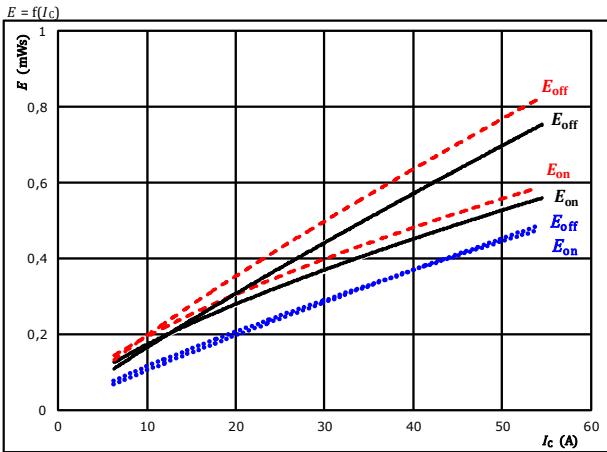
P_{rec} (100%) =	10,57	kW
E_{rec} (100%) =	0,44	mJ
t_{Erec} =	0,13	μs



Boost Switching Characteristics

figure 1. IGBT

Typical switching energy losses as a function of collector current

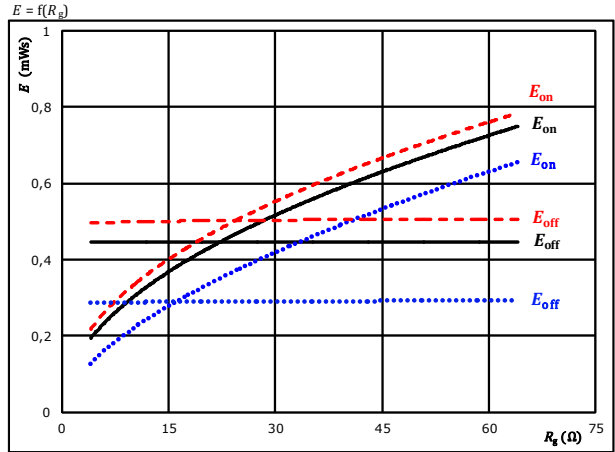


With an inductive load at

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

figure 2. IGBT

Typical switching energy losses as a function of gate resistor

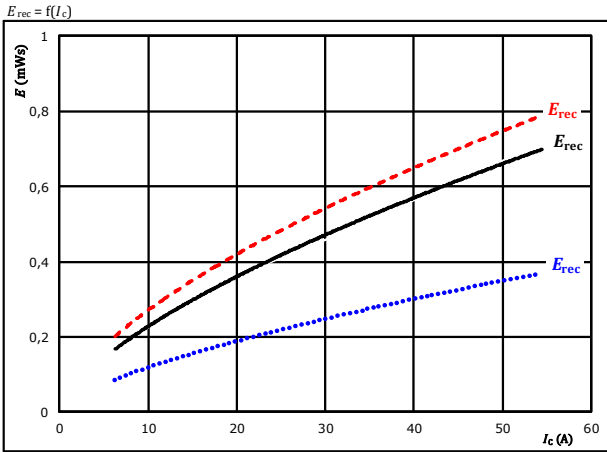


With an inductive load at

$V_{CE} = 350$ V	$T_j: 25$ °C
$V_{GE} = \pm 15$ V	125 °C	————
$I_c = 30$ A	150 °C	- - - -

figure 3. FWD

Typical reverse recovered energy loss as a function of collector current

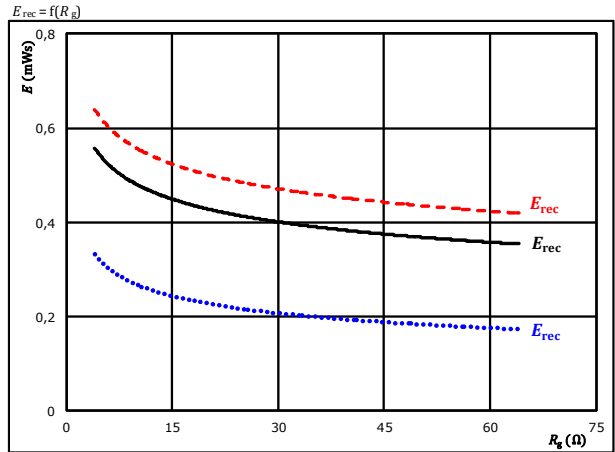


With an inductive load at

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

figure 4. FWD

Typical reverse recovered energy loss as a function of gate resistor



With an inductive load at

$V_{CE} = 350$ V	$T_j: 25$ °C
$V_{GE} = \pm 15$ V	125 °C	————
$I_c = 30$ A	150 °C	- - - -

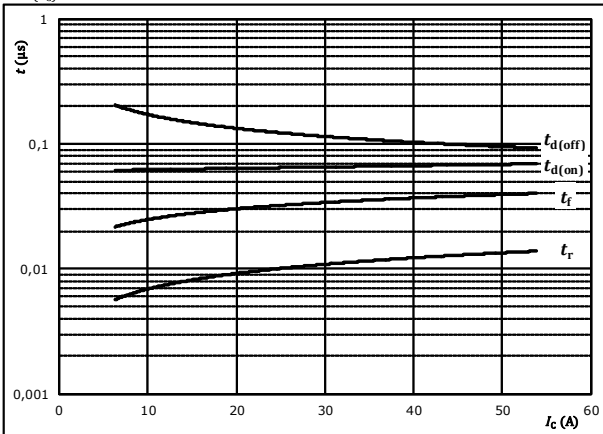


Boost Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$$t = f(I_c)$$



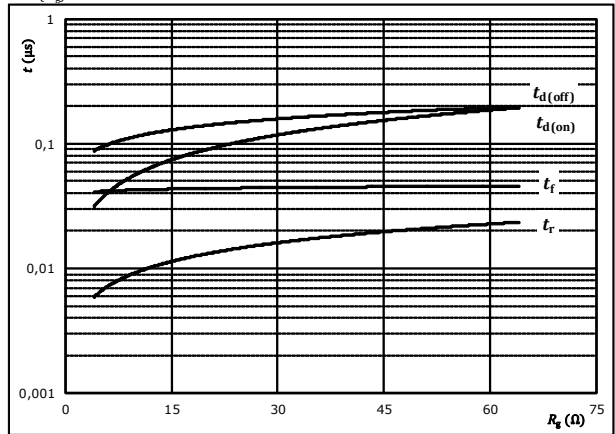
With an inductive load at

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

figure 6. IGBT

Typical switching times as a function of gate resistor

$$t = f(R_g)$$



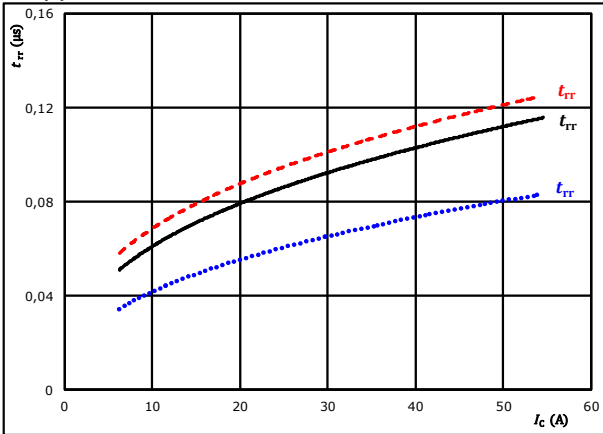
With an inductive load at

$T_j =$	150	°C
$V_{CE} =$	350	V
$V_{GE} =$	±15	V
$I_c =$	30	A

figure 7. FWD

Typical reverse recovery time as a function of collector current

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

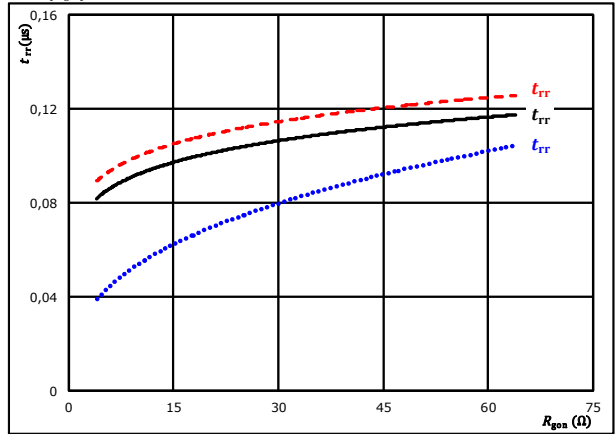


At	$V_{CE} =$	350	V	$T_j =$	25 °C
	$V_{GE} =$	±15	V		125 °C	————
	$R_{g(on)} =$	16	Ω		150 °C	- - - -

figure 8. FWD

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

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



At	$V_{CE} =$	350	V	$T_j =$	25 °C
	$V_{GE} =$	±15	V		125 °C	————
	$I_c =$	30	A		150 °C	- - - -

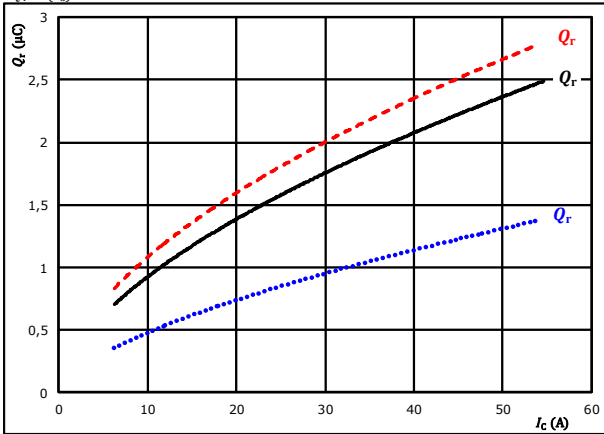


Boost Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$

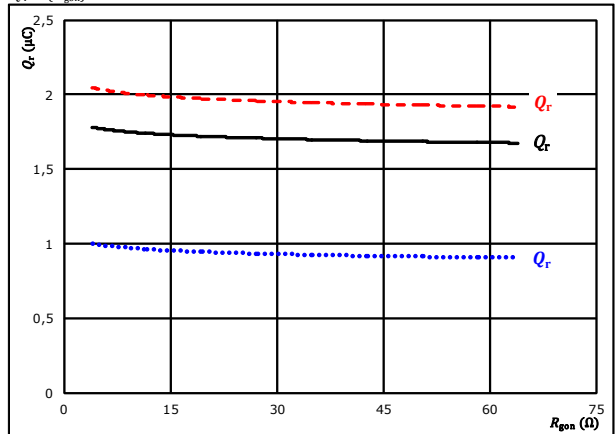


At $V_{CE} = 350$ V $T_j = 25$ °C (dotted blue)
 $V_{GE} = \pm 15$ V $T_j = 125$ °C (solid black)
 $R_{gpn} = 16$ Ω $T_j = 150$ °C (dashed red)

figure 10. FWD

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

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

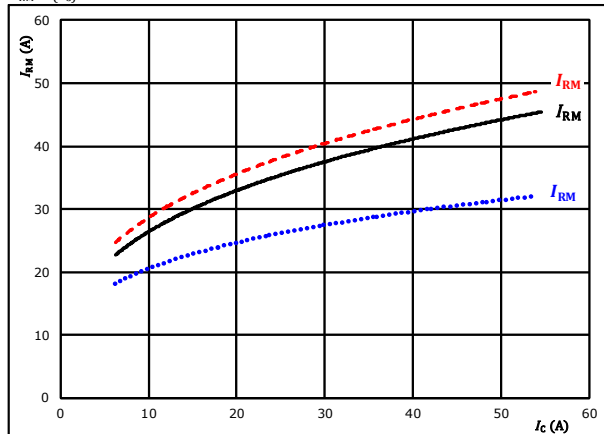


At $V_{CE} = 350$ V $T_j = 25$ °C (dotted blue)
 $V_{GE} = \pm 15$ V $T_j = 125$ °C (solid black)
 $I_c = 30$ A $T_j = 150$ °C (dashed red)

figure 11. FWD

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

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

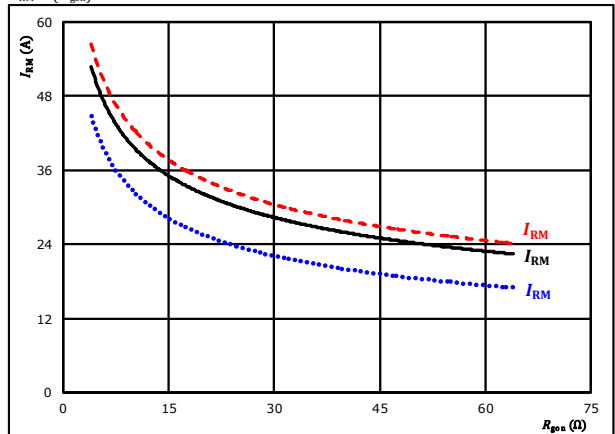


At $V_{CE} = 350$ V $T_j = 25$ °C (dotted blue)
 $V_{GE} = \pm 15$ V $T_j = 125$ °C (solid black)
 $R_{gpn} = 16$ Ω $T_j = 150$ °C (dashed red)

figure 12. FWD

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

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



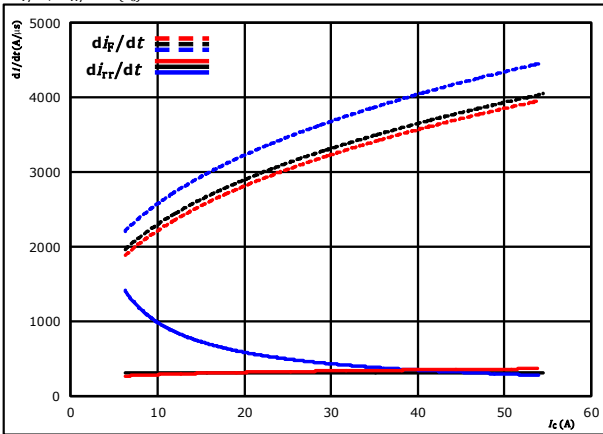
At $V_{CE} = 350$ V $T_j = 25$ °C (dotted blue)
 $V_{GE} = \pm 15$ V $T_j = 125$ °C (solid black)
 $I_c = 30$ A $T_j = 150$ °C (dashed red)



Boost Switching Characteristics

figure 13. FWD

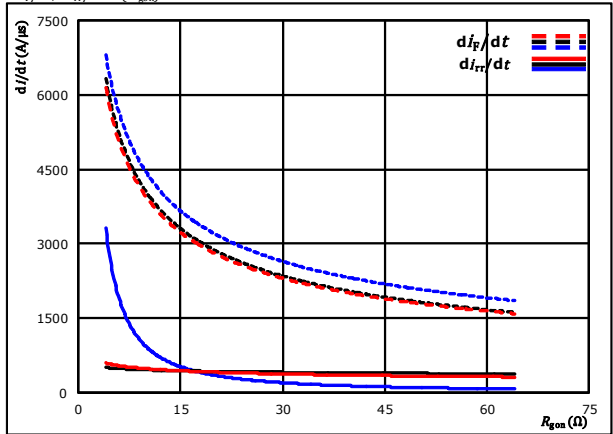
Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_f/dt, di_{rr}/dt = f(I_c)$



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

figure 14. FWD

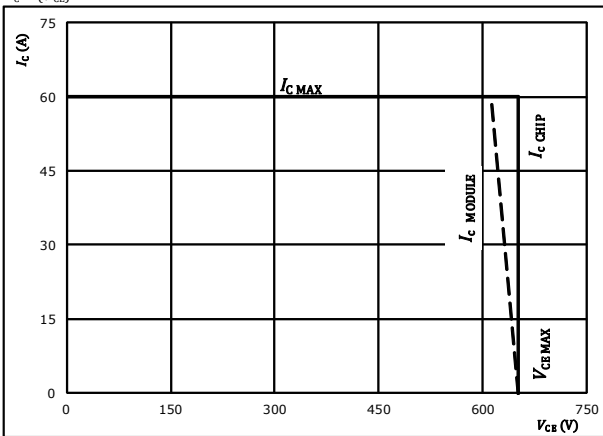
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
 $di_f/dt, di_{rr}/dt = f(R_{g(on)})$



At $V_{CE} = 350$ V $T_j = 25$ °C (dotted blue)
 $V_{GE} = \pm 15$ V $T_j = 125$ °C (solid black)
 $I_c = 30$ A $T_j = 150$ °C (dashed red)

figure 15. IGBT

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



At $T_j = 175$ °C
 $R_{g(on)} = 16$ Ω
 $R_{g(off)} = 16$ Ω



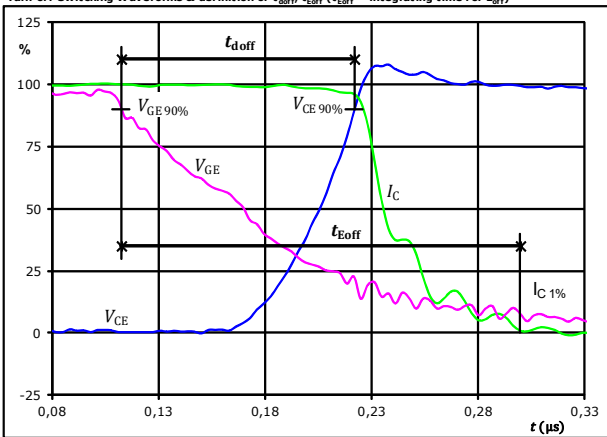
Boost Switching Definitions

General conditions

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

figure 1. IGBT

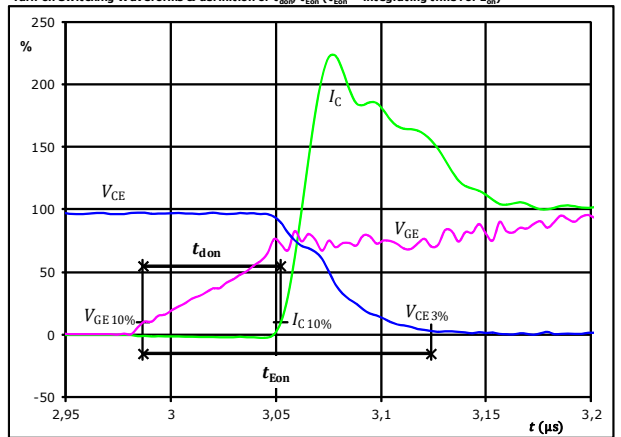
Turn-off Switching Waveforms & definition of t_{doff} , t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{CE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	30	A
$t_{doff} =$	0,109	μ s
$t_{Eoff} =$	0,187	μ s

figure 2. IGBT

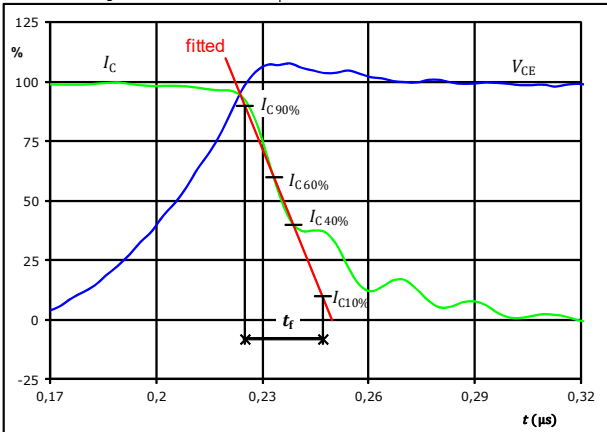
Turn-on Switching Waveforms & definition of t_{don} , t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{CE}(0\%) =$	-15	V
$V_{GE}(100\%) =$	15	V
$V_C(100\%) =$	350	V
$I_C(100\%) =$	30	A
$t_{don} =$	0,069	μ s
$t_{Eon} =$	0,137	μ s

figure 3. IGBT

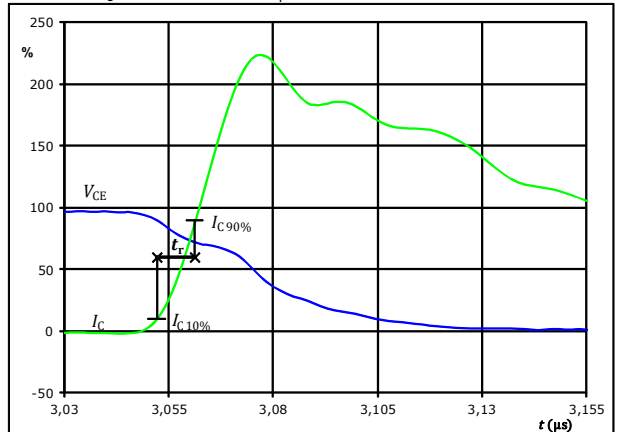
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%) =$	350	V
$I_C(100\%) =$	30	A
$t_f =$	0,027	μ s

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r



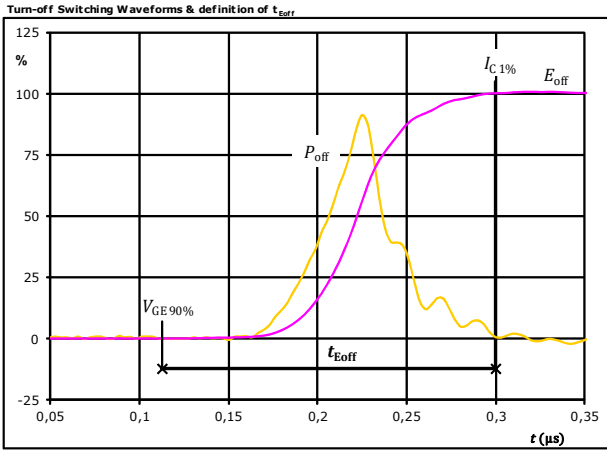
$V_C(100\%) =$	350	V
$I_C(100\%) =$	30	A
$t_r =$	0,010	μ s



Vincotech

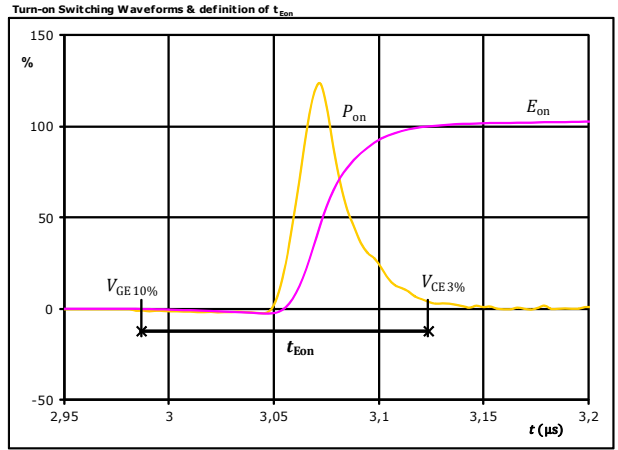
Boost Switching Characteristics

figure 5. IGBT



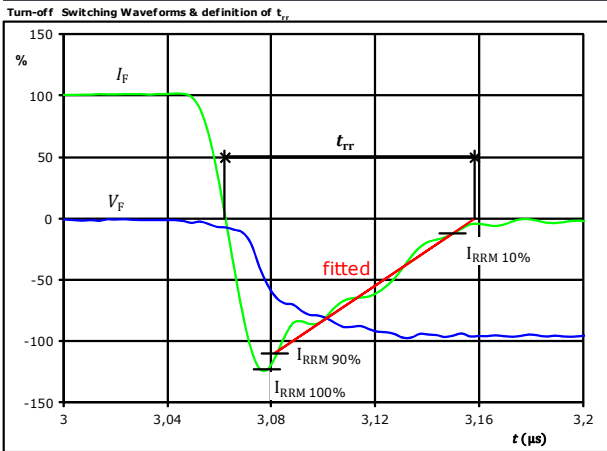
$P_{off}(100\%) =$	10,57	kW
$E_{off}(100\%) =$	0,45	mJ
$t_{Eoff} =$	0,19	μs

figure 6. IGBT



$P_{on}(100\%) =$	10,57	kW
$E_{on}(100\%) =$	0,36	mJ
$t_{Eon} =$	0,14	μs

figure 7. FWD



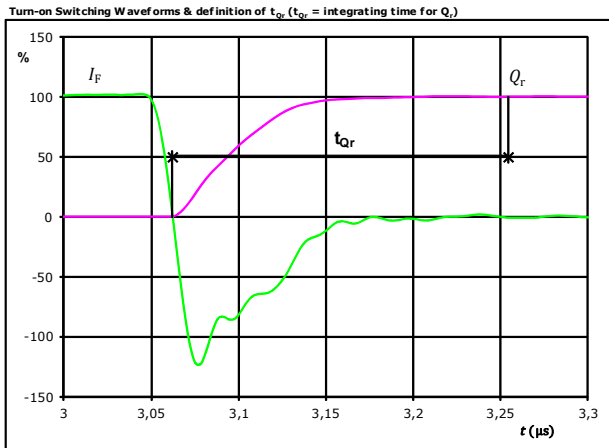
$V_F(100\%) =$	350	V
$I_F(100\%) =$	30	A
$I_{RRM}(100\%) =$	-36	A
$t_{tr} =$	0,095	μs



Vincotech

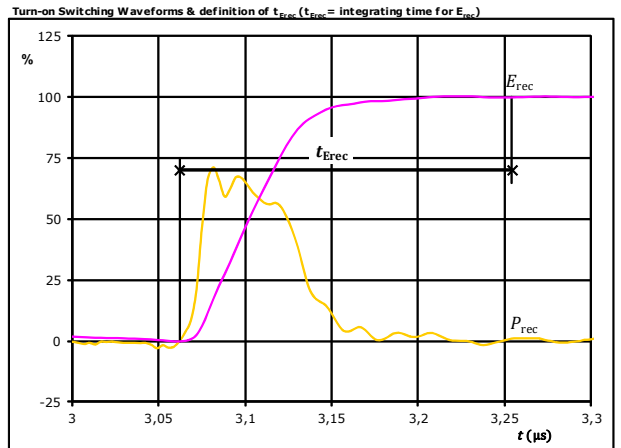
Boost Switching Characteristics

figure 8. FWD



I_F (100%) =	30	A
Q_r (100%) =	1,73	μC
t_{Qr} =	0,19	μs

figure 9. FWD



P_{rec} (100%) =	10,57	kW
E_{rec} (100%) =	0,46	mJ
t_{Erec} =	0,19	μs



Vincotech

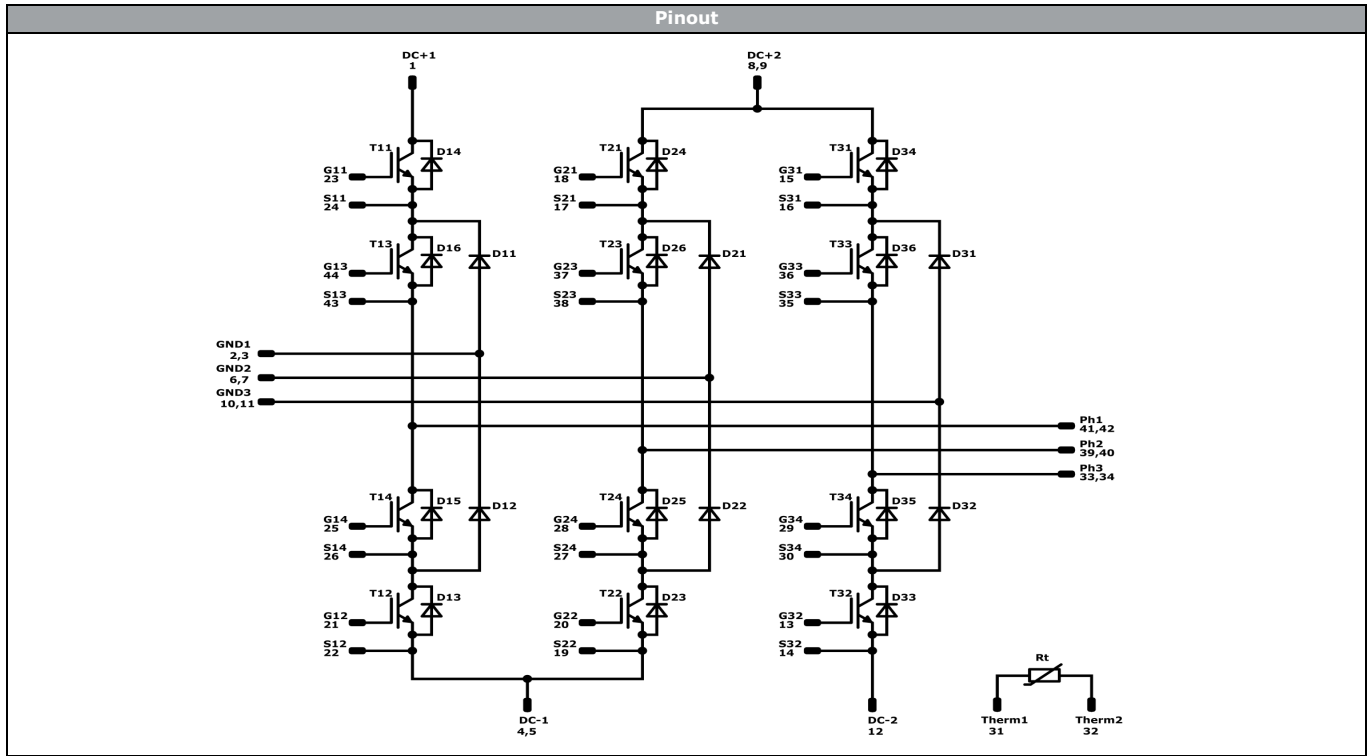
Ordering Code & Marking								
Version				Ordering Code				
without thermal paste 12 mm housing with press-fit pins				10-PH07N3A030S5-M894F98T				
NN-NNNNNNNNNNNN TTTTUVVWWYY UL VIN LLLLL SSSS			Text	Name	Date code	UL & VIN	Lot	Serial
			Datamatrix	NN-NNNNNNNNNNNN-TTTTTUVV Type&Ver TTTTUVV	Lot number LLLLL	Serial SSSS	Date code WWYY	LLLLL

Pin Table				Outline	
Pin	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	30 A	Buck Switch	
D11, D21, D31, D12, D22, D32	FWD	650 V	30 A	Buck Diode	
T13, T23, T33, T14, T24, T34	IGBT	650 V	30 A	Boost Switch	
D13, D23, D33, D14, D24, D34	FWD	650 V	30 A	Boost Diode	
D15, D16, D25, D26, D35, D36	Inverse Diode	650 V	30 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 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-PH07N3A030S5-M894F98T-D3-14	18 Jan. 2018	Added Boost Switching characteristics and Graphs, Update Rth Values, Schematic corrected	1, 2, 3, 5, 6, 7, 24-30

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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.