Vincotech

10-PY12M3A025SH04-M746F43Y
datasheet

flow **3xMNPC 1** **1200 V / 25 A**

Features

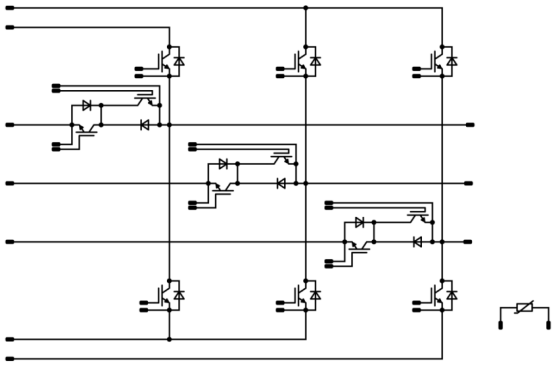
- 3 phase mixed voltage component topology
- Neutral point clamped inverter
- Reactive power capability
- Low inductance layout

flow 1 12 mm housing

Target applications

- Solar Inverters
- UPS

Schematic



Types

- 10-PY12M3A025SH04-M746F43Y

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Buck Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	T_j = T_{jmax} T_s = 80 °C	31	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	75	A
Total power dissipation	P_{tot}	T_j = T_{jmax} T_s = 80 °C	94	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC} V_{CC}	T_j ≤ 150 °C V_{GE} = 15 V	10 800	µs V
Maximum Junction Temperature	T_{jmax}		175	°C

Maximum Ratings

T_j = 25 °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	$T_j = T_{jmax}$ T_s = 80 °C	28	A
Repetitive peak forward current	I_{FRM}		40	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	51	W
Maximum junction temperature	T_{jmax}		175	°C
Boost Switch				
Collector-emitter voltage	V_{CES}		650	V
Collector current	I_C	$T_j = T_{jmax}$ T_s = 80 °C	27	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	57	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC} V_{CC}	$T_j \leq$ 150 °C V_{GE} = 15 V	6 360	µs V
Maximum Junction Temperature	T_{jmax}		175	°C
Boost Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	21	A
Repetitive peak forward current	I_{FRM}		30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	56	W
Maximum Junction Temperature	T_{jmax}		175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Module Properties				
Thermal Properties				
Storage temperature	T_{stg}		-40…+125	°C
Operation temperature under switching condition	T_{jop}		-40…(T_{jmax} - 25)	°C
Isolation Properties				
Isolation voltage	V_{isol}	DC Test Voltage* t_p = 2 s	6000	V
		AC Voltage t_p = 1 min	2500	V
Creepage distance			min. 12,7	mm
Clearance			7,89	mm
Comparative Tracking Index	CTI		> 200	

*100 % tested in production

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	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,00085	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		25	25 125 150	1,78	1,98 2,38 2,49	2,42	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			6	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		1430		pF
Output capacitance	C_{oes}							115		
Reverse transfer capacitance	C_{res}							75		
Gate charge	Q_g		15	960	25	25		115		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,01		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 16 Ω R_{gon} = 16 Ω	±15	350	15	25 125 150		71 74 72		ns
Rise time	t_r					25 125 150		16 19 20		
Turn-off delay time	$t_{d(off)}$					25 125 150		162 217 230		
Fall time	t_f					25 125 150		24 84 81		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 0,6 µC Q_{rFWD} = 1 µC Q_{rFWD} = 1,2 µC				25 125 150		0,240 0,368 0,410		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,380 0,651 0,730		

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				20	25 125 150		1,56 1,51 1,51	1,92	V
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,88		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 1013 A/µs di/dt = 1058 A/µs di/dt = 1027 A/µs	±15	350	15	25 125 150		17 19 19		A
Reverse recovery time	t_{rr}					25 125 150		64 100 113		ns
Recovered charge	Q_r					25 125 150		0,619 1,020 1,182		µC
Reverse recovered energy	E_{rec}					25 125 150		0,131 0,210 0,246		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		871 132 130		A/µs

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	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,00029	25	5,1	5,8	6,4	V
Collector-emitter saturation voltage	V_{CEsat}		15		20	25 125	1,03	1,49 1,67	1,87	V
Collector-emitter cut-off current	I_{CES}		0	650		25			5	µA
Gate-emitter leakage current	I_{GES}		20	0		25			150	nA
Internal gate resistance	r_g							none		Ω
Input capacitance	C_{ies}	f = 1 MHz	0	25		25		1100		pF
Output capacitance	C_{oes}							71		
Reverse transfer capacitance	C_{res}							32		
Gate charge	Q_g		15	480	20	25		120		nC
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,66		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 16 Ω R_{gon} = 16 Ω	±15	350	15	25 125 150		86 85 85		ns
Rise time	t_r					25 125 150		16 18 18		
Turn-off delay time	$t_{d(off)}$					25 125 150		132 155 159		
Fall time	t_f					25 125 150		27 93 89		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 1,3 µC Q_{rFWD} = 2,3 µC Q_{rFWD} = 2,6 µC				25 125 150		0,289 0,395 0,416		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,487 0,651 0,685		

Characteristic Values

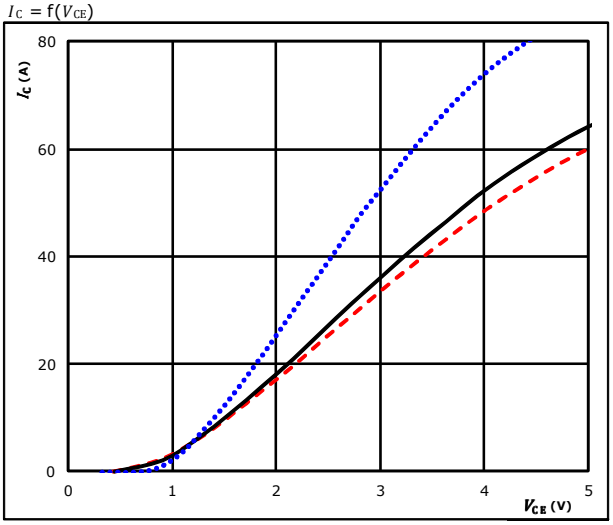
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Boost Diode										
Static										
Forward voltage	V_F				15	25 150		1,80 1,77	2,05	V
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,70		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 1226 A/µs di/dt = 1048 A/µs di/dt = 1011 A/µs	±15	350	15	25 125 150		21 24 24		A
Reverse recovery time	t_{rr}					25 125 150		143 309 327		ns
Recovered charge	Q_r					25 125 150		1,321 2,345 2,626		µC
Reverse recovered energy	E_{rec}					25 125 150		0,357 0,643 0,721		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		1617 1191 1065		A/µs
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P					25		5		mW
Power dissipation constant						25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %				25		3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %				25		4000		K
Vincotech NTC Reference									I	

Buck Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

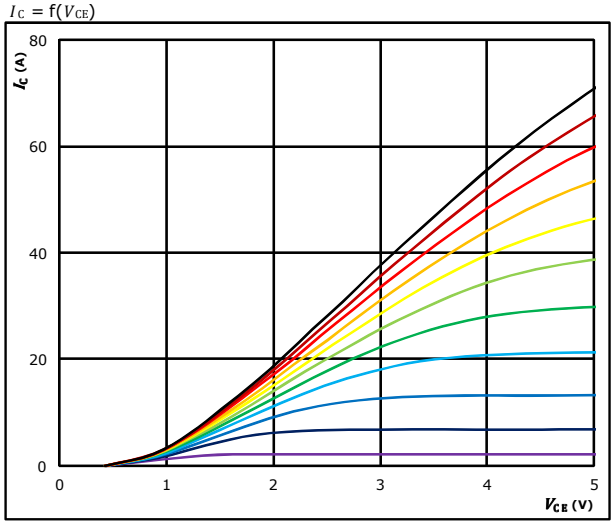


t_p =	250	µs		
V_{GE} =	15	V	T_j:	25 °C, 125 °C, 150 °C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

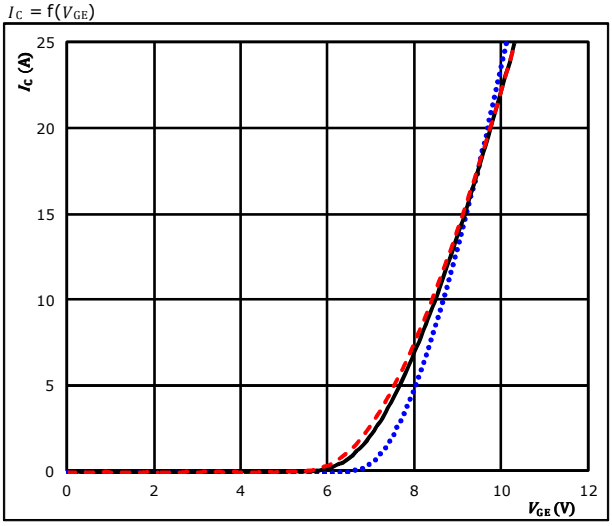


t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

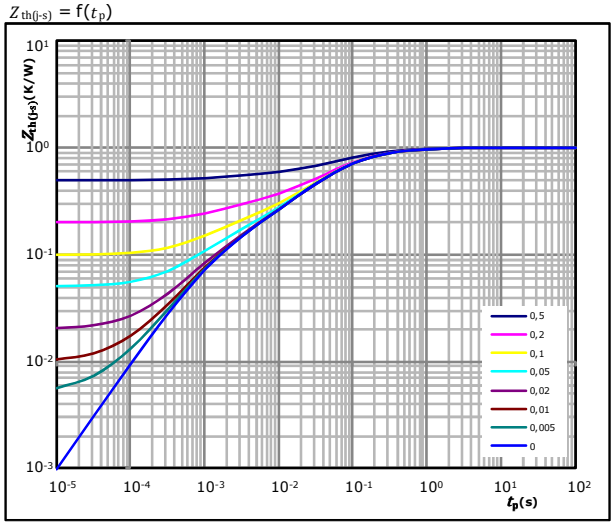


t_p =	100	µs		
V_{CE} =	10	V	T_j:	25 °C, 125 °C, 150 °C

figure 4. **IGBT**

Transient Thermal Impedance as function of Pulse duration

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,01	K/W

IGBT thermal model values

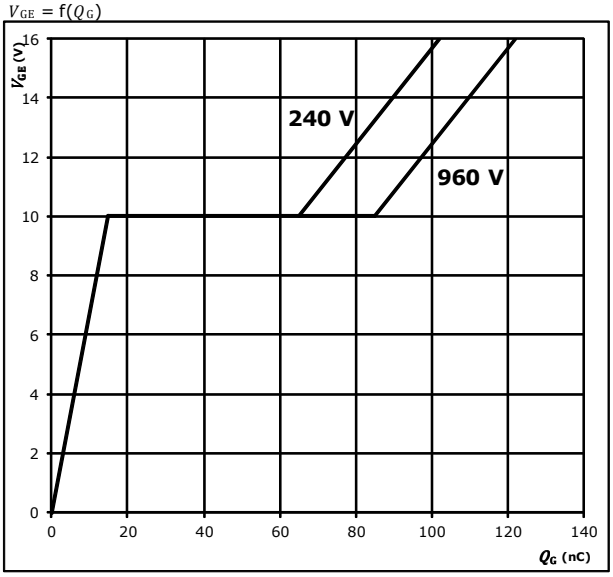
R (K/W)	τ (s)
8,44E-02	1,03E+00
2,46E-01	1,79E-01
4,48E-01	5,38E-02
1,38E-01	1,04E-02
5,48E-02	1,66E-03
3,85E-02	8,73E-04

Buck Switch Characteristics

figure 5. **IGBT**

Gate voltage vs Gate charge

$V_{GE} = f(Q_G)$



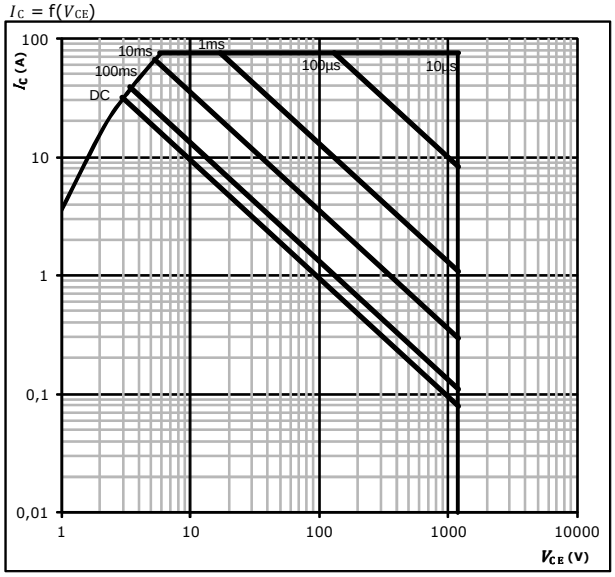
At

I_C= 25 A

figure 6. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



At

D = single pulse

T_s = 80 °C

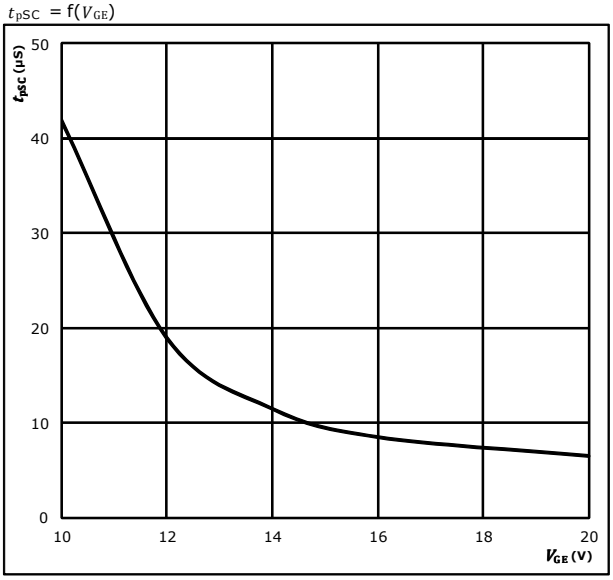
V_{GE} = ±15 V

T_j = T_{jmax}

figure 7. **IGBT**

Short circuit duration as a function of V_{GE}

$t_{pSC} = f(V_{GE})$



At

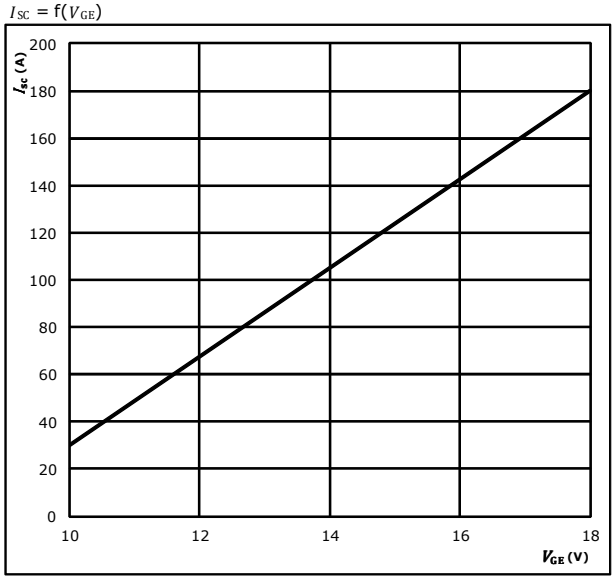
V_{CE} = 600 V

$T_j \leq$ 150 °C

figure 8. **IGBT**

Typical short circuit current as a function of V_{GE}

$I_{SC} = f(V_{GE})$



At

$V_{CE} \leq$ 600 V

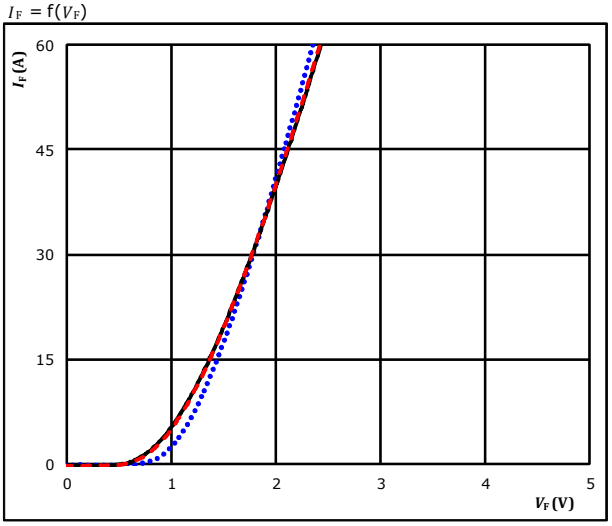
$T_j \leq$ 25 °C

Buck Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



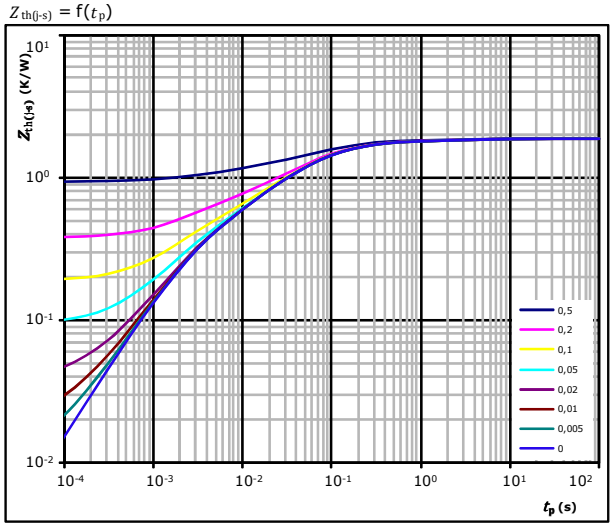
t_p = 250 µs

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

$R_{th(j-s)}$ = 1,88 K/W

FWD thermal model values

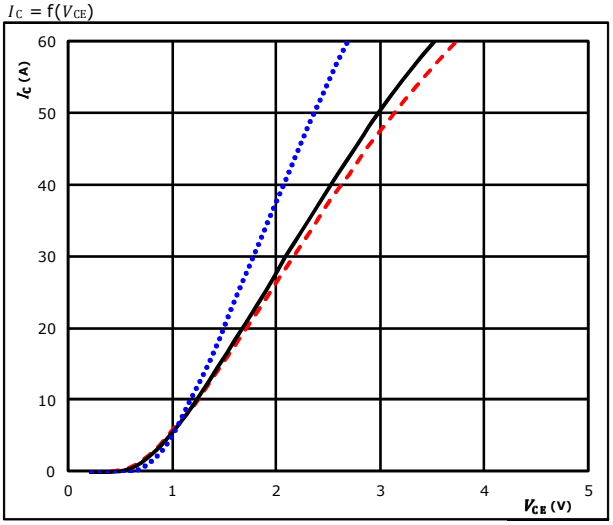
R (K/W)	τ (s)
8,42E-02	3,60E+00
1,79E-01	3,95E-01
8,86E-01	7,08E-02
4,50E-01	1,69E-02
2,75E-01	2,45E-03

Boost Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

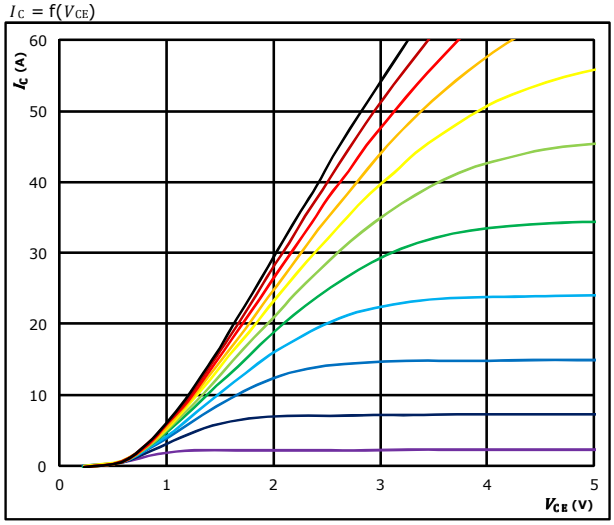


t_p =	250	µs		
V_{GE} =	15	V	T_j:	25 °C
				125 °C
				150 °C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

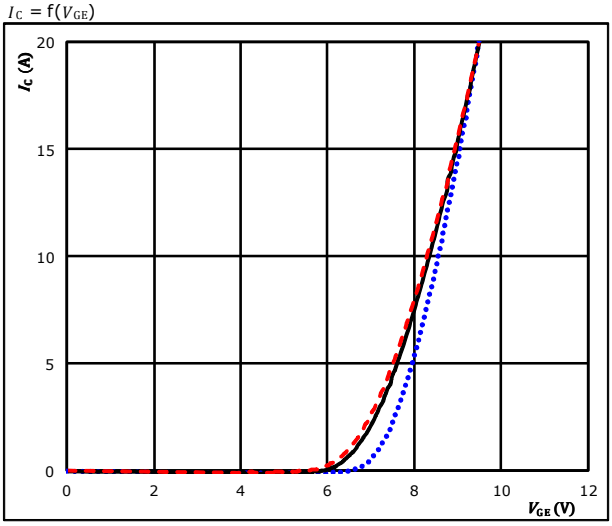


t_p =	250	µs
T_j =	150	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

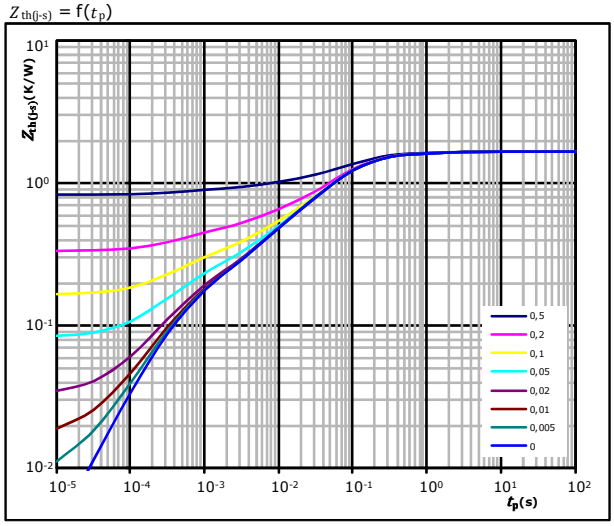


t_p =	100	µs		
V_{CE} =	10	V	T_j:	25 °C
				125 °C
				150 °C

figure 4. **IGBT**

Transient Thermal Impedance as function of Pulse duration

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,66	K/W

IGBT thermal model values

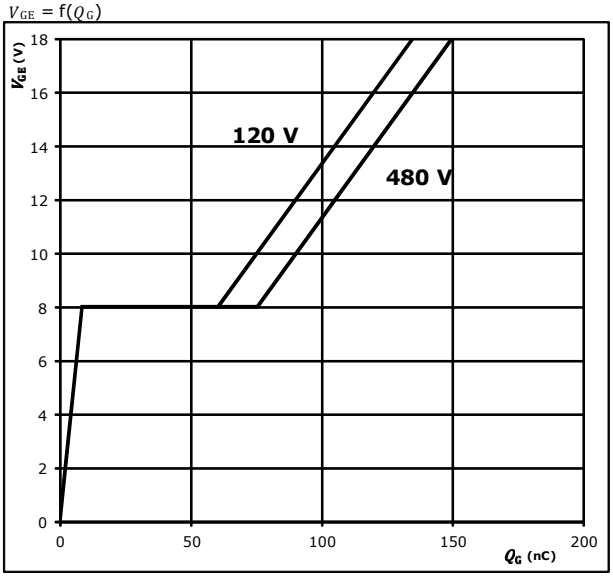
R (K/W)	τ (s)
7,52E-02	1,78E+00
1,97E-01	2,71E-01
9,36E-01	6,94E-02
1,96E-01	1,36E-02
1,32E-01	3,45E-03
1,27E-01	4,12E-04

Boost Switch Characteristics

figure 5. **IGBT**

Gate voltage vs Gate charge

$V_{GE} = f(Q_G)$



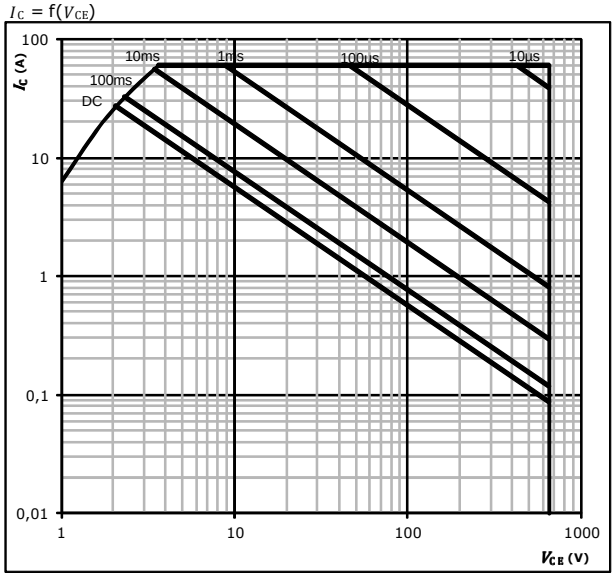
At

I_C= 20 A

figure 6. **IGBT**

Safe operating area

$I_C = f(V_{CE})$



At

D = single pulse

T_s = 80 °C

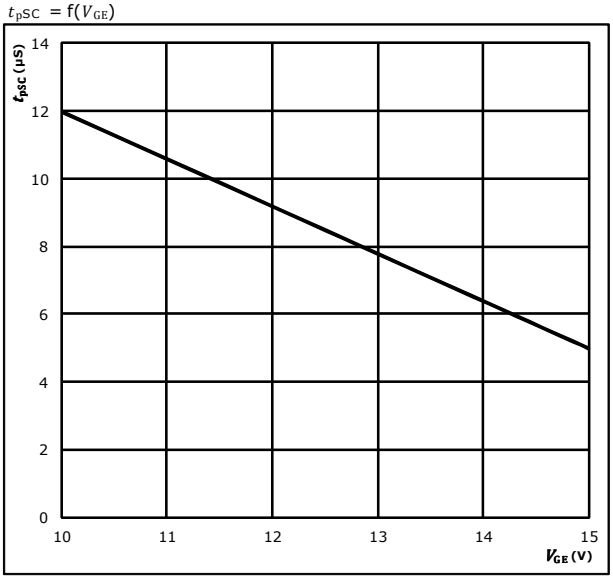
V_{GE} = ±15 V

T_j = T_{jmax}

figure 7. **IGBT**

Short circuit duration as a function of V_{GE}

$t_{pSC} = f(V_{GE})$



At

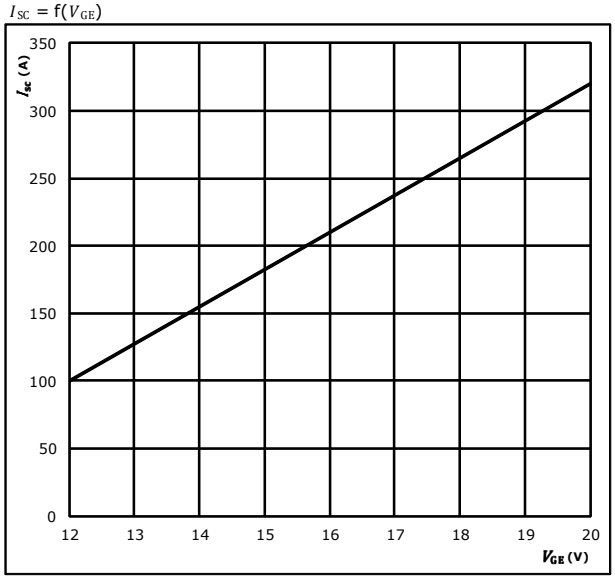
V_{CE} = 650 V

$T_j \leq$ 175 °C

figure 8. **IGBT**

Typical short circuit current as a function of V_{GE}

$I_{SC} = f(V_{GE})$



At

$V_{CE} \leq$ 650 V

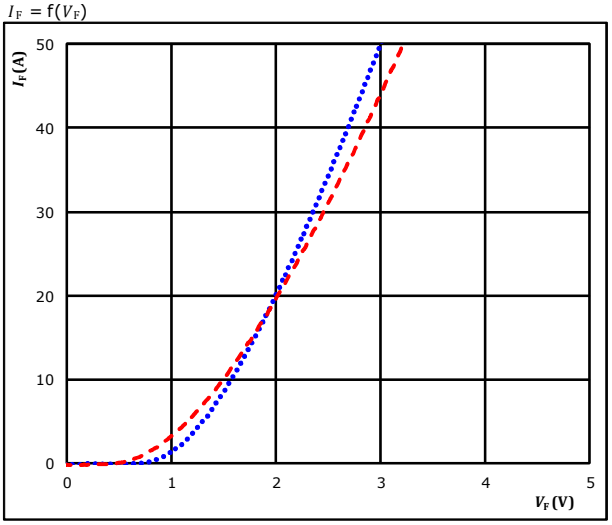
$T_j \leq$ 175 °C

Boost Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



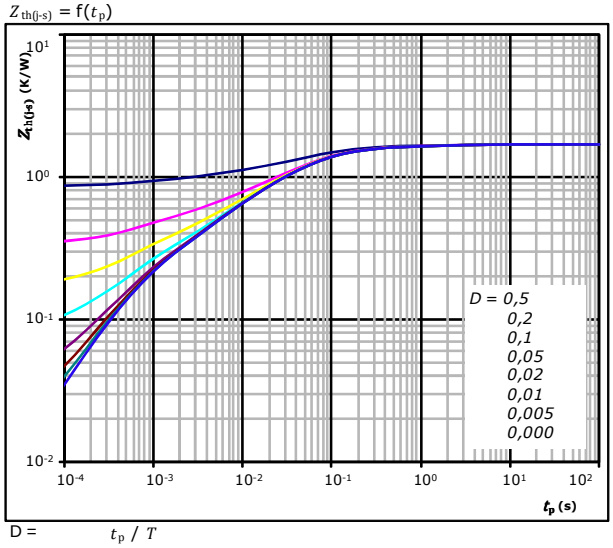
t_p = 250 µs

T_j: 25 °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

$R_{th(j-s)}$ = 1,70 K/W

FWD thermal model values

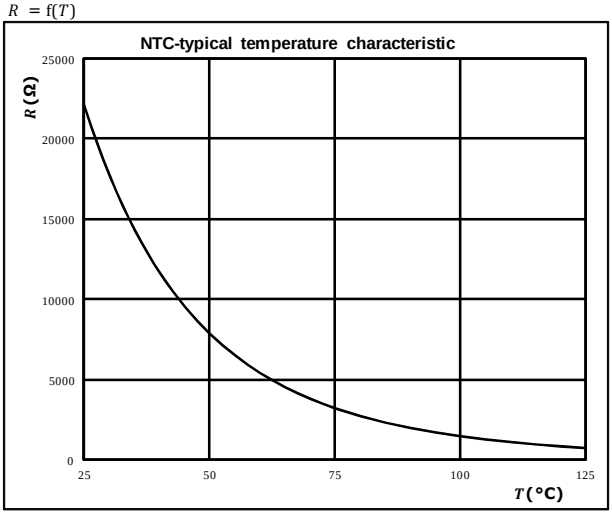
R (K/W)	τ (s)
5,72E-02	2,79E+00
1,30E-01	3,93E-01
6,56E-01	6,76E-02
4,62E-01	1,96E-02
2,31E-01	4,04E-03
1,63E-01	5,86E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic as a function of temperature

$R = f(T)$

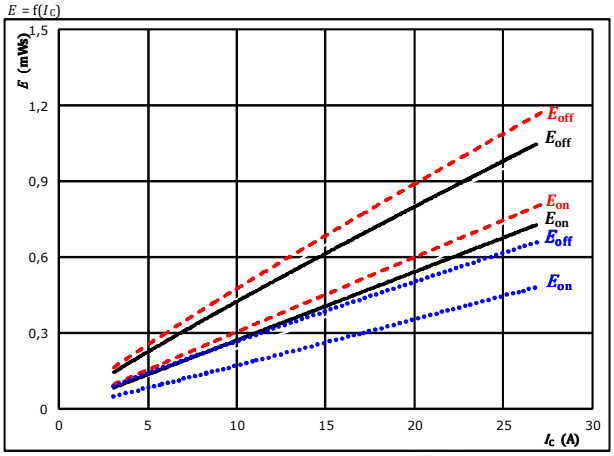


Buck Switching Characteristics

figure 1. IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



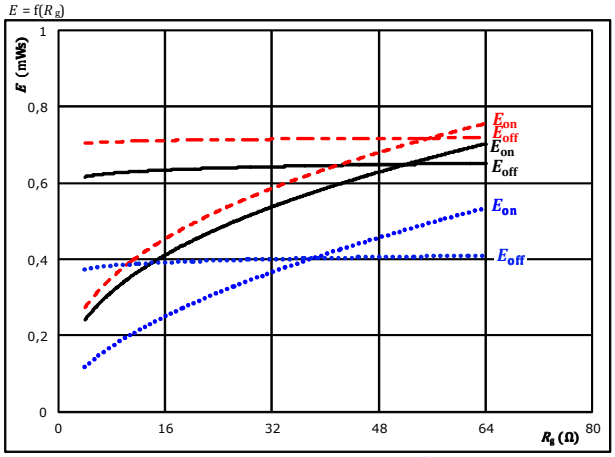
With an inductive load at

V_{CE} =	350	V	T_J:	25 °C	·····
V_{GE} =	±15	V		125 °C	———
R_{gon} =	16	Ω		150 °C	– – –
R_{goff} =	16	Ω			

figure 2. IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



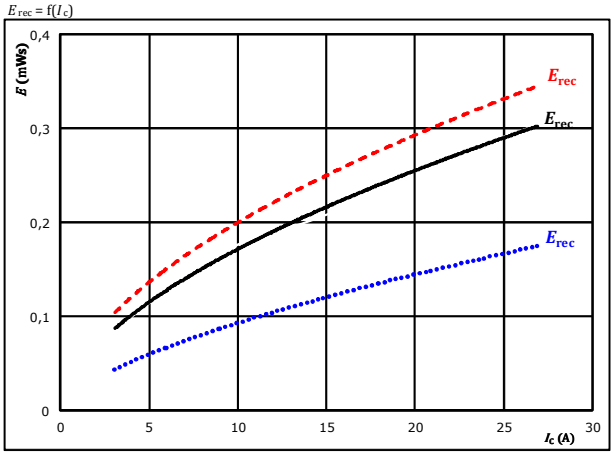
With an inductive load at

V_{CE} =	350	V	T_J:	25 °C	·····
V_{GE} =	±15	V		125 °C	———
I_C =	15	A		150 °C	– – –

figure 3. FWD

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



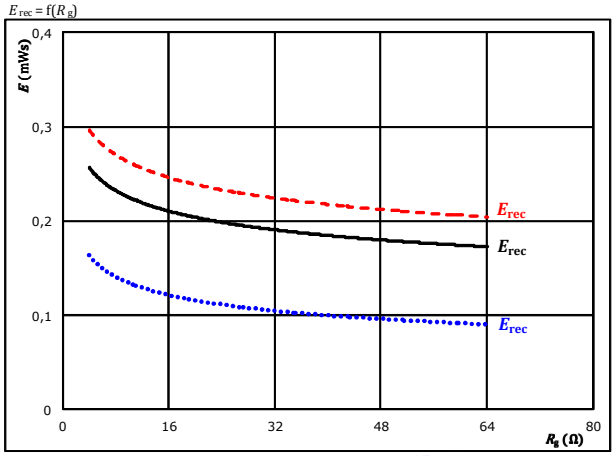
With an inductive load at

V_{CE} =	350	V	T_J:	25 °C	·····
V_{GE} =	±15	V		125 °C	———
R_{gon} =	16	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

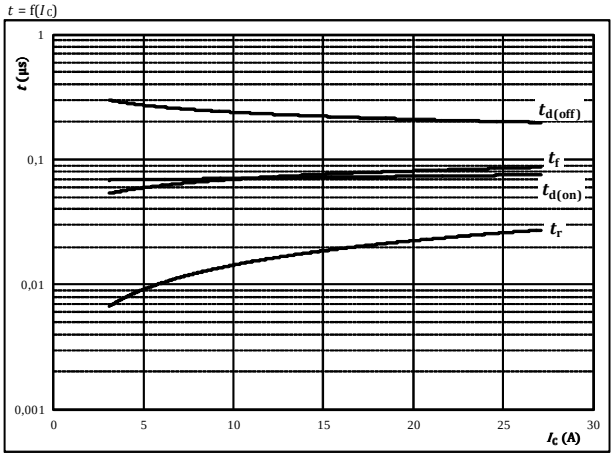
V_{CE} =	350	V	T_J:	25 °C	·····
V_{GE} =	±15	V		125 °C	———
I_C =	15	A		150 °C	– – –

Buck Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



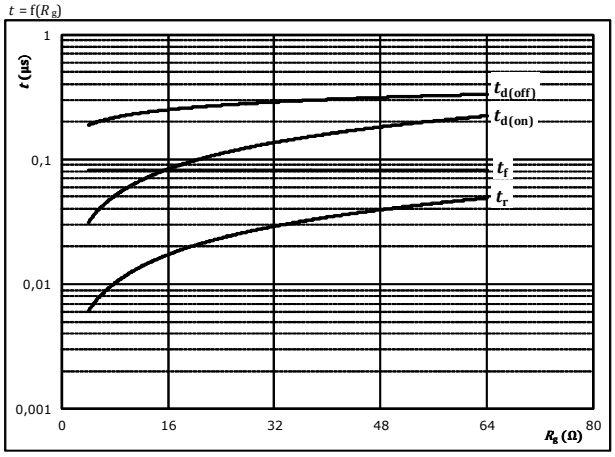
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



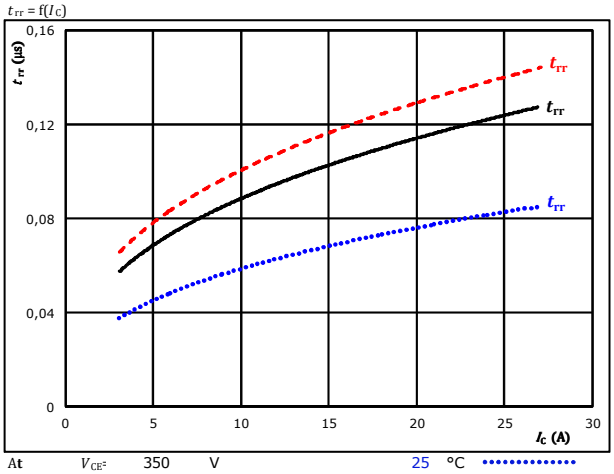
With an inductive load at

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

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



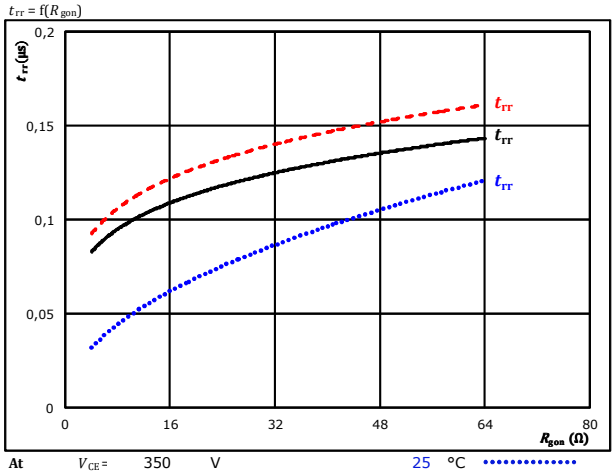
At

V_{CE} =	350	V		25	°C
V_{GE} =	±15	V	T_j:	125	°C
R_{gon} =	16	Ω		150	°C

figure 8. **FWD**

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

$t_{rr} = f(R_{gon})$



At

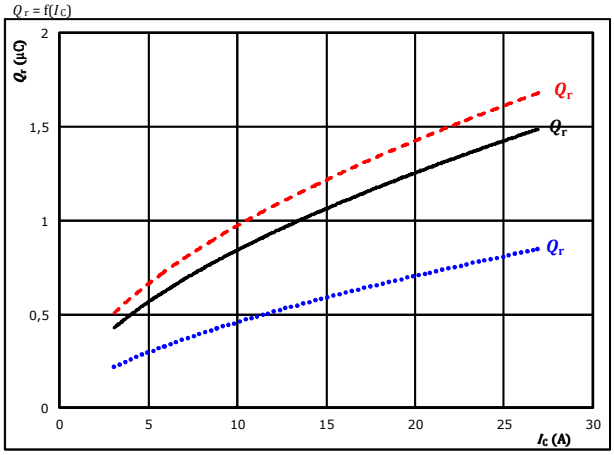
V_{CE} =	350	V		25	°C
V_{GE} =	±15	V	T_j:	125	°C
I_C =	15	A		150	°C

Buck Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

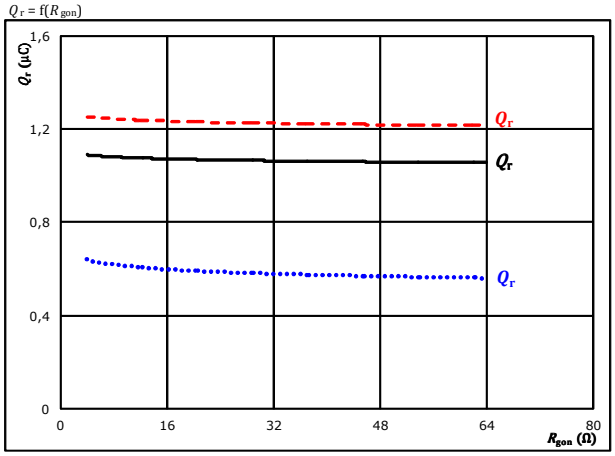


At						
	V_{CE} =	350	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	R_{gon} =	16	Ω		150 °C	

figure 10. FWD

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

$Q_r = f(R_{gon})$

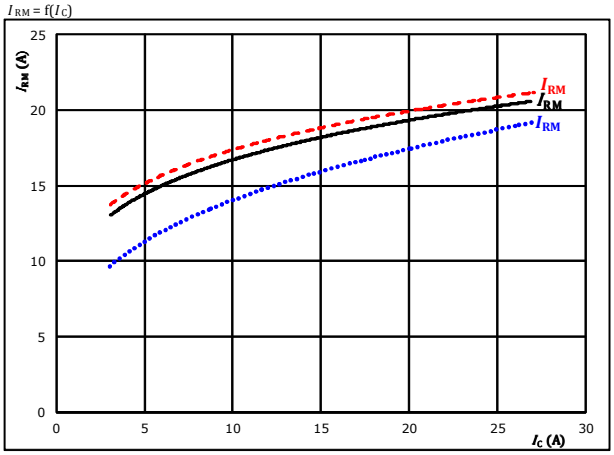


At						
	V_{CE}=	350	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	I_C=	15	A		150 °C	

figure 11. FWD

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

$I_{RM} = f(I_C)$

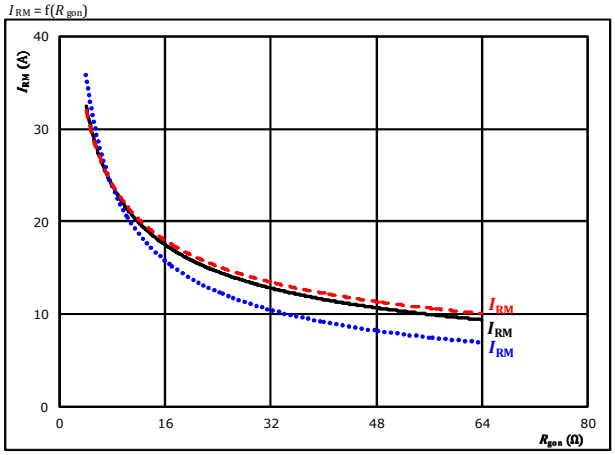


At						
	V_{CE}:	350	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	R_{gon} =	16	Ω		150 °C	

figure 12. FWD

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

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



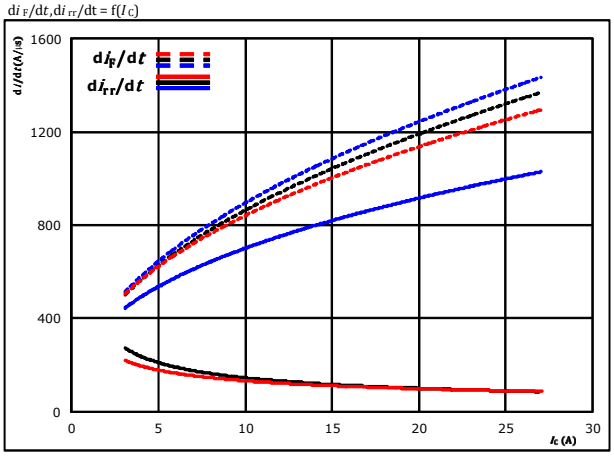
At						
	V_{CE} =	350	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	I_C =	15	A		150 °C	

Buck Switching Characteristics

figure 13. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of collector current

$di_F/dt, di_{rr}/dt = f(I_C)$

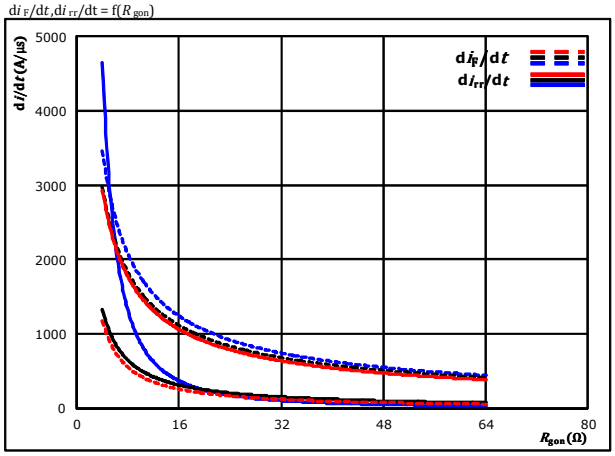


At						
V_{CE} =	350	V	T_j:	25 °C	•••••••••••••••
V_{GE} =	±15	V		125 °C	———
R_{gon} =	16	Ω		150 °C	– – – –

figure 14. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor

$di_F/dt, di_{rr}/dt = f(R_{gon})$

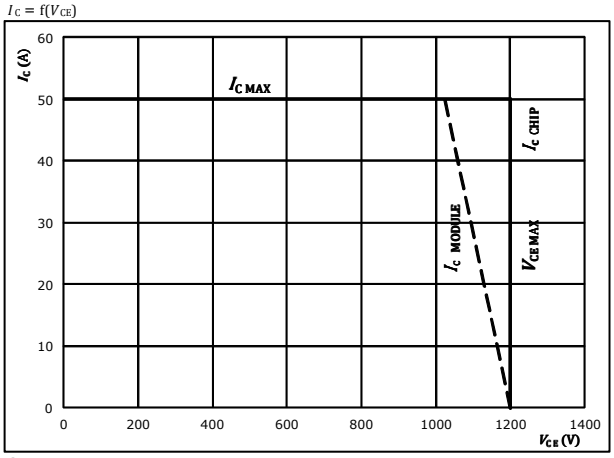


At						
V_{CE} =	350	V	T_j:	25 °C	•••••••••••••••
V_{GE} =	±15	V		125 °C	———
I_C =	15	A		150 °C	– – – –

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	175	°C
R_{gon} =	16	Ω
R_{goff} =	16	Ω

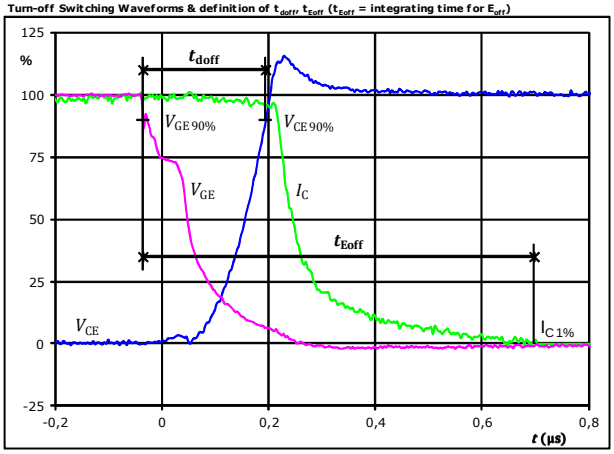
Buck Switching Definitions

General conditions

T_j	=	**150 °C**
R_{gon}	=	**16 Ω**
R_{goff}	=	**16 Ω**

figure 1. IGBT

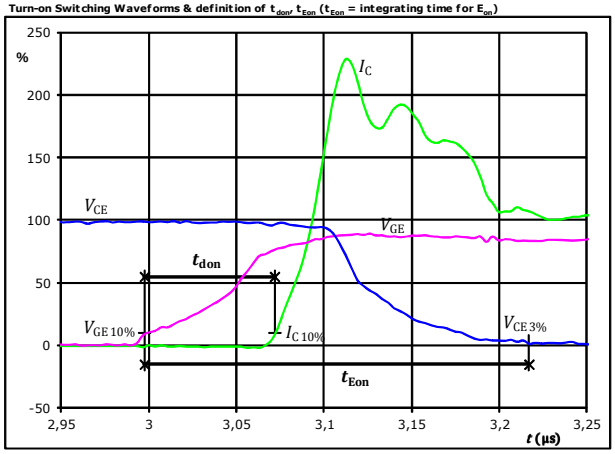
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	15	A
t_{doff} =	0,230	µs
t_{Eoff} =	0,733	µs

figure 2. IGBT

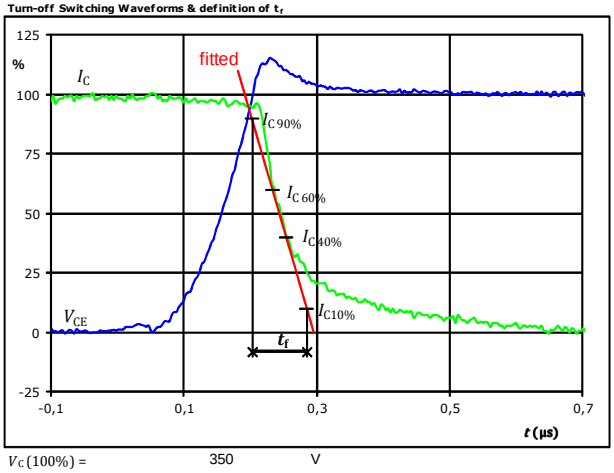
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	15	A
t_{don} =	0,072	µs
t_{Eon} =	0,219	µs

figure 3. IGBT

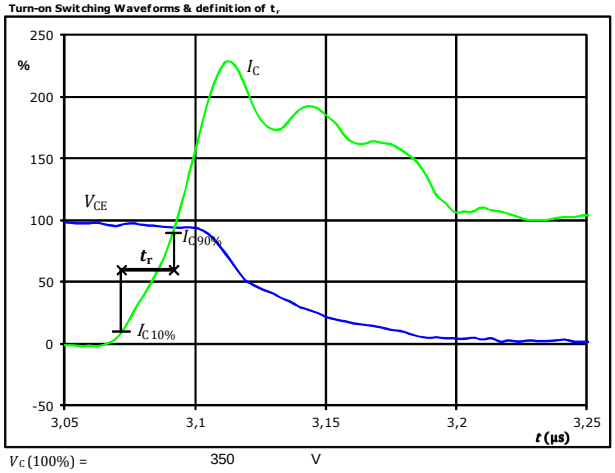
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	15	A
t_f =	0,081	µs

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

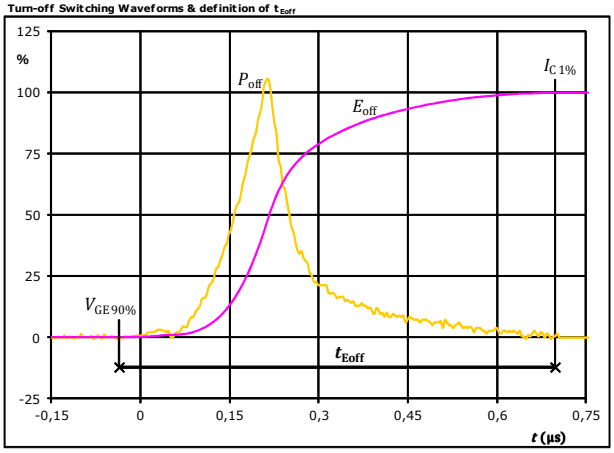


$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	15	A
t_r =	0,020	µs

Buck Switching Characteristics

figure 5. **IGBT**

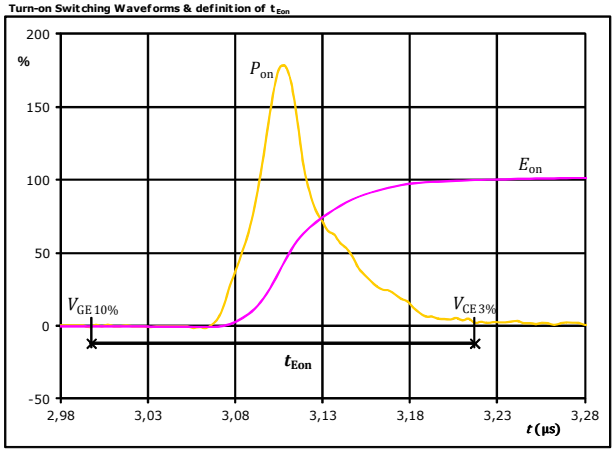
Turn-off Switching Waveforms & definition of t_{Eoff}



$P_{off}(100\%)$ =	5,28	kW
$E_{off}(100\%)$ =	0,73	mJ
t_{Eoff} =	0,73	µs

figure 6. **IGBT**

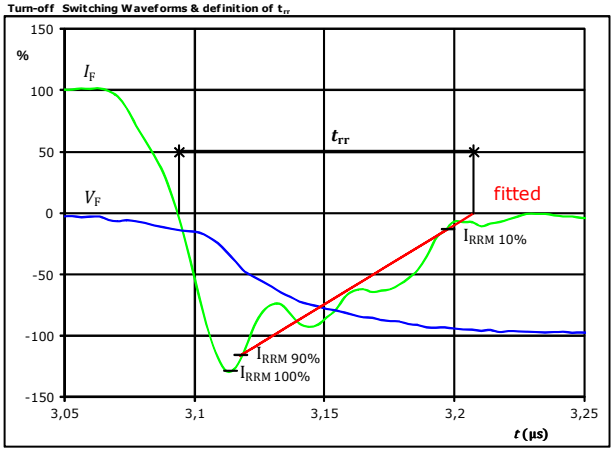
Turn-on Switching Waveforms & definition of t_{Eon}



$P_{on}(100\%)$ =	5,28	kW
$E_{on}(100\%)$ =	0,41	mJ
t_{Eon} =	0,22	µs

figure 7. **FWD**

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

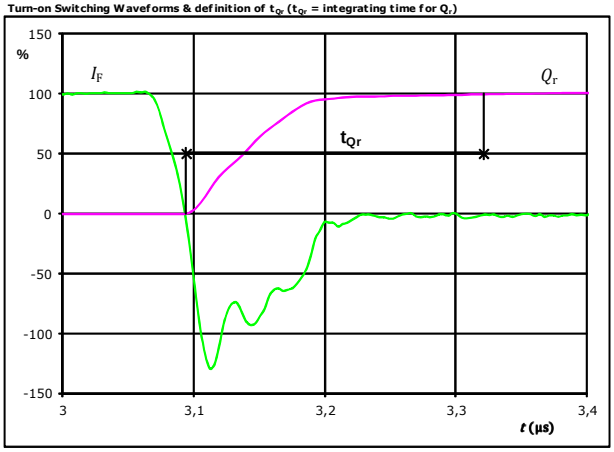


$V_F(100\%)$ =	350	V
$I_F(100\%)$ =	15	A
$I_{RRM}(100\%)$ =	-19	A
t_{rr} =	0,113	µs

Buck Switching Characteristics

figure 8. **FWD**

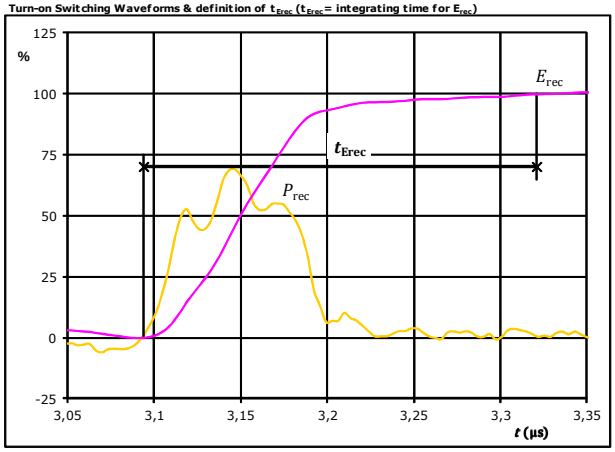
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	15	A
Q_r (100%) =	1,18	µC
t_{Qr} =	0,23	µs

figure 9. **FWD**

Turn-on Switching Waveforms & definition of t_{Erec} (t_{Erec} = integrating time for E_{rec})



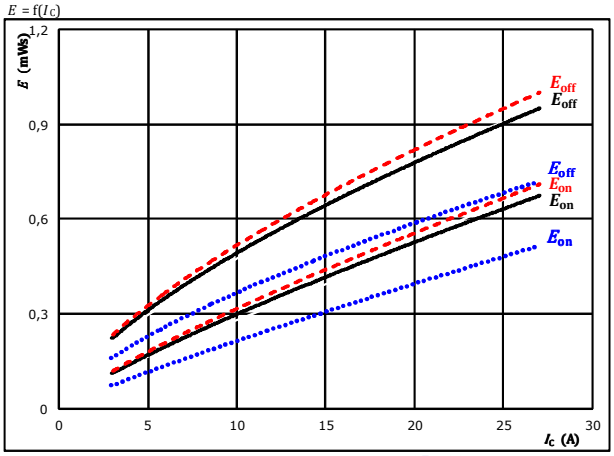
P_{rec} (100%) =	5,28	kW
E_{rec} (100%) =	0,25	mJ
t_{Erec} =	0,23	µs

Boost Switching Characteristics

figure 1. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



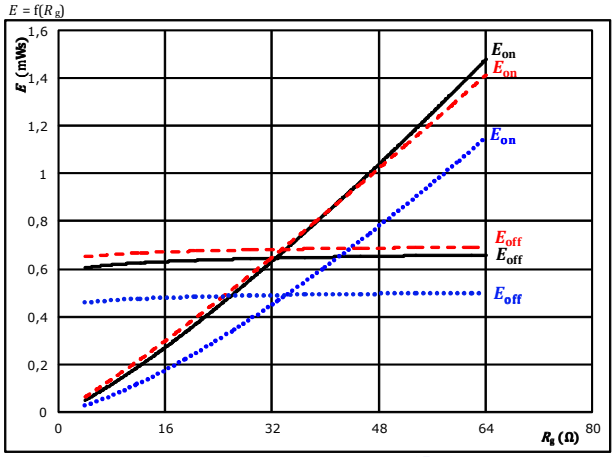
With an inductive load at

V_{CE} =	350	V	T_J:	25 °C	·····
V_{GE} =	±15	V		125 °C	———
R_{gon} =	16	Ω		150 °C	– – –
R_{goff} =	16	Ω			

figure 2. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



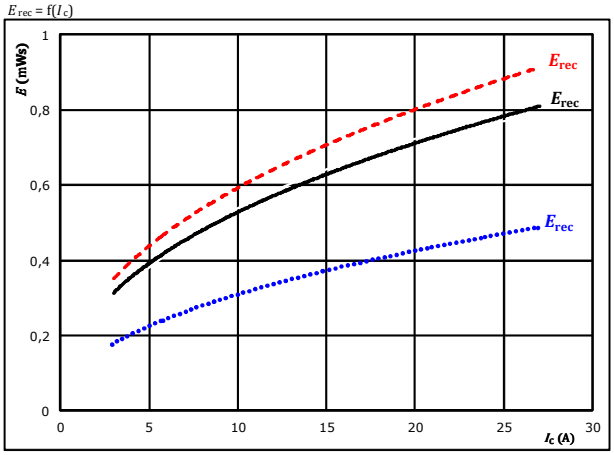
With an inductive load at

V_{CE} =	350	V	T_J:	25 °C	·····
V_{GE} =	±15	V		125 °C	———
I_C =	15	A		150 °C	– – –

figure 3. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



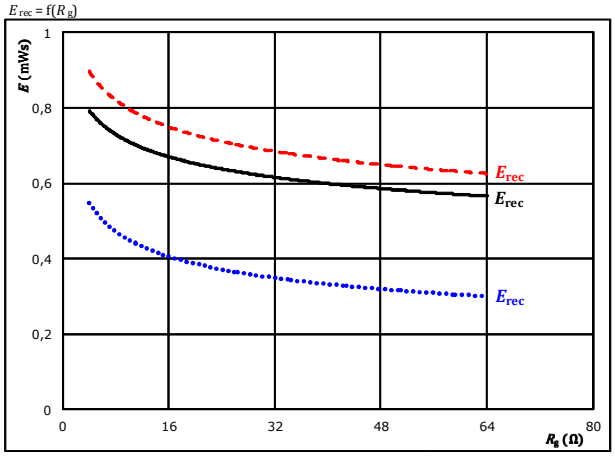
With an inductive load at

V_{CE} =	350	V	T_J:	25 °C	·····
V_{GE} =	±15	V		125 °C	———
R_{gon} =	16	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

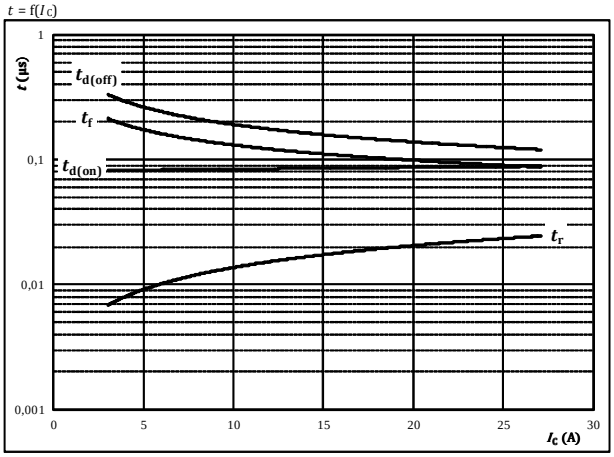
V_{CE} =	350	V	T_J:	25 °C	·····
V_{GE} =	±15	V		125 °C	———
I_C =	15	A		150 °C	– – –

Boost Switching Characteristics

figure 5. IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



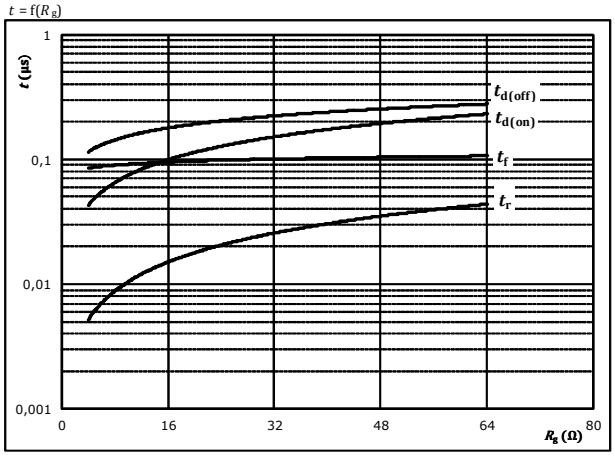
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 6. IGBT

Typical switching times as a function of gate resistor

$t = f(R_g)$



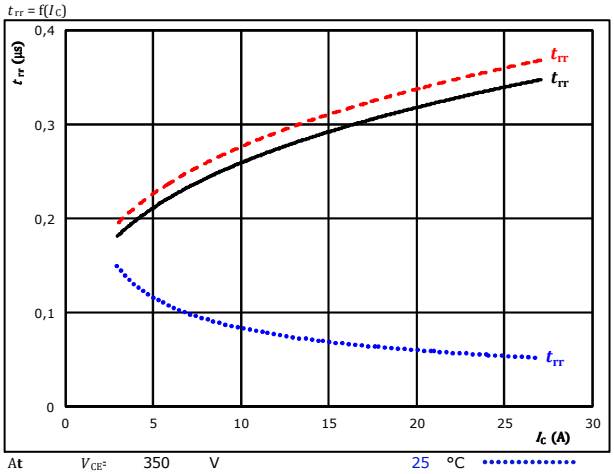
With an inductive load at

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

figure 7. FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

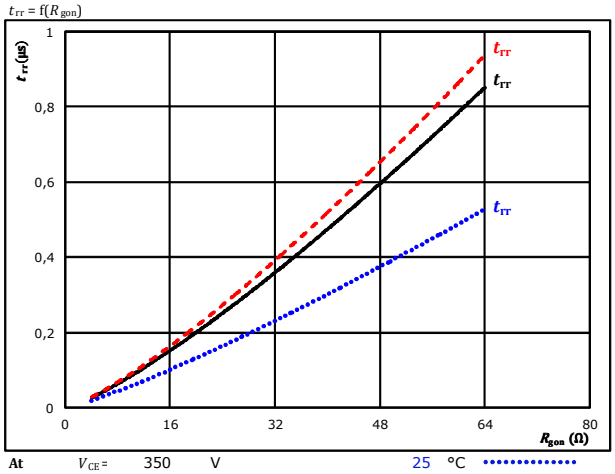


At					
	V_{CE} =	350	V		25 °C
	V_{GE} =	±15	V	T_j:	125 °C
	R_{gon} =	16	Ω		150 °C

figure 8. FWD

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

$t_{rr} = f(R_{gon})$



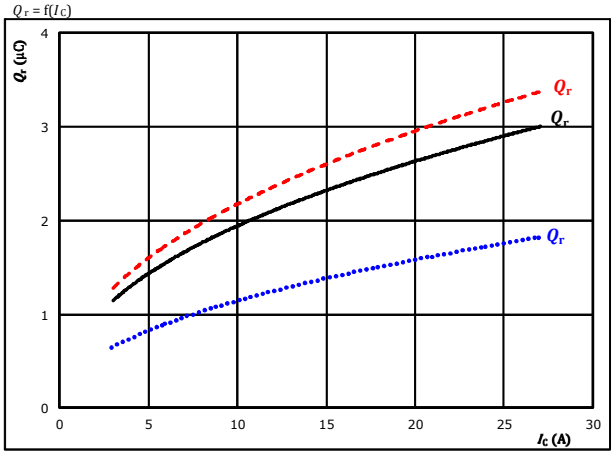
At					
	V_{CE} =	350	V		25 °C
	V_{GE} =	±15	V	T_j:	125 °C
	I_C =	15	A		150 °C

Boost Switching Characteristics

figure 9. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

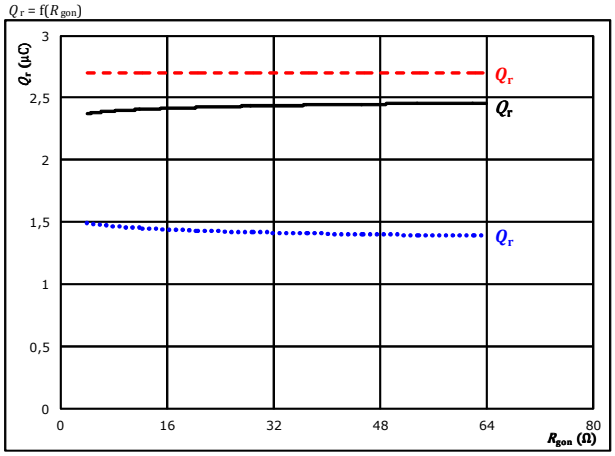


At						
	V_{CE} =	350	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	R_{gon} =	16	Ω		150 °C	

figure 10. **FWD**

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

$Q_r = f(R_{gon})$

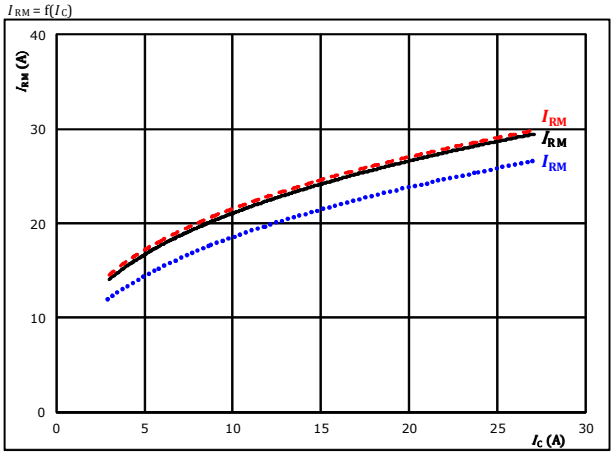


At						
	V_{CE}=	350	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	I_C=	15	A		150 °C	

figure 11. **FWD**

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

$I_{RM} = f(I_C)$

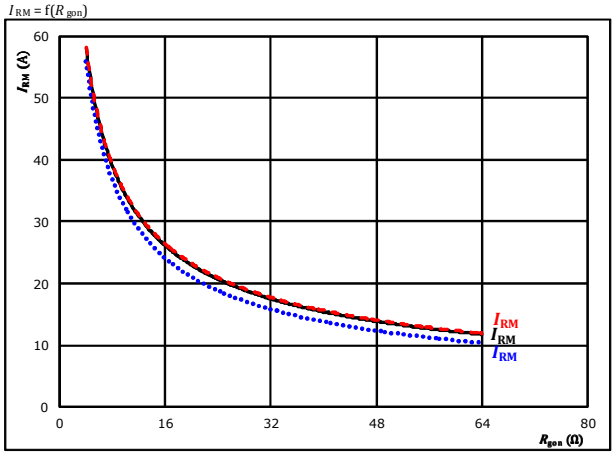


At						
	V_{CE}:	350	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	R_{gon} =	16	Ω		150 °C	

figure 12. **FWD**

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

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



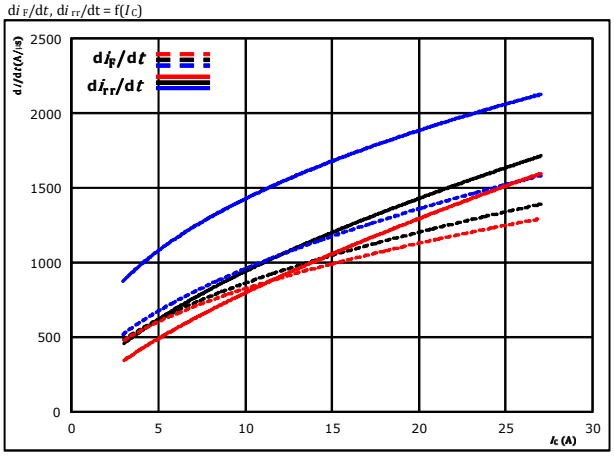
At						
	V_{CE} =	350	V		25 °C	
	V_{GE} =	±15	V	T_j:	125 °C	
	I_C =	15	A		150 °C	

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, $di_{rr}/dt = f(I_C)$

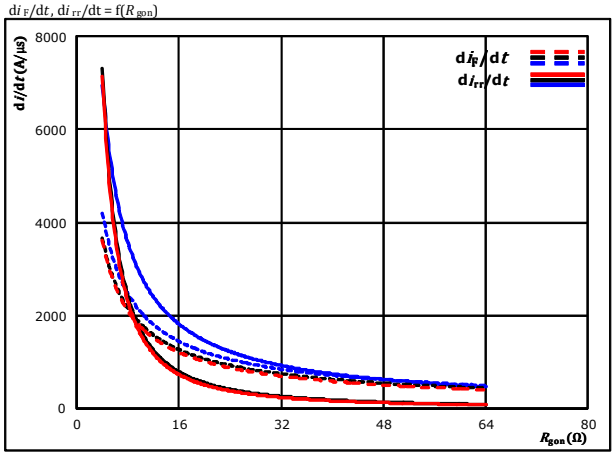


At						
V_{CE} =	350	V	T_j:	25 °C	•••••••••••••••
V_{GE} =	±15	V		125 °C	———
R_{gon} =	16	Ω		150 °C	– – – –

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, $di_{rr}/dt = f(R_{gon})$

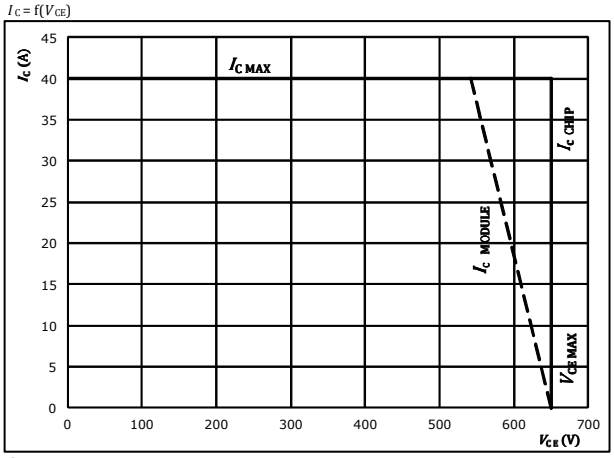


At						
V_{CE} =	350	V	T_j:	25 °C	•••••••••••••••
V_{GE} =	±15	V		125 °C	———
I_C =	15	A		150 °C	– – – –

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	175	°C
R_{gon} =	16	Ω
R_{goff} =	16	Ω

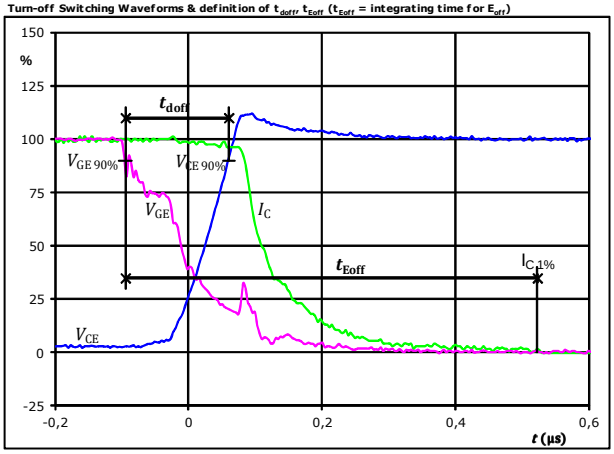
Boost Switching Definitions

General conditions

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

figure 1. IGBT

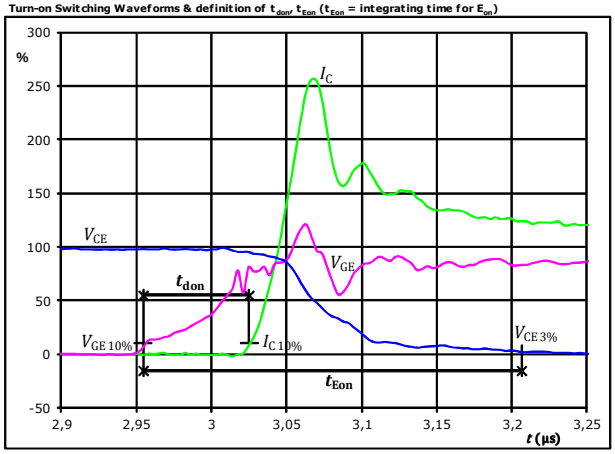
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	15	A
t_{doff} =	0,155	µs
t_{Eoff} =	0,618	µs

figure 2. IGBT

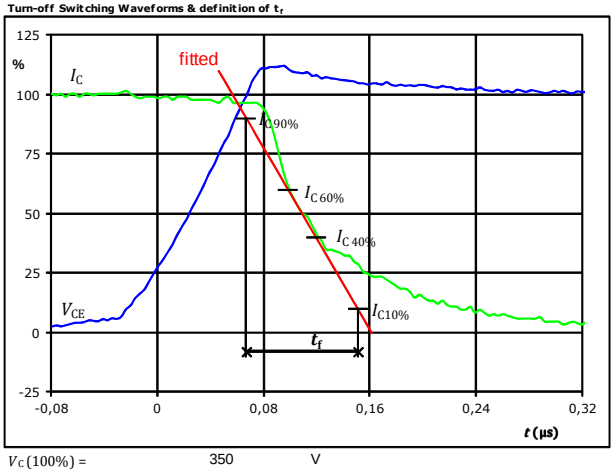
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



$V_{GE}(0\%)$ =	-15	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	15	A
t_{don} =	0,085	µs
t_{Eon} =	0,252	µs

figure 3. IGBT

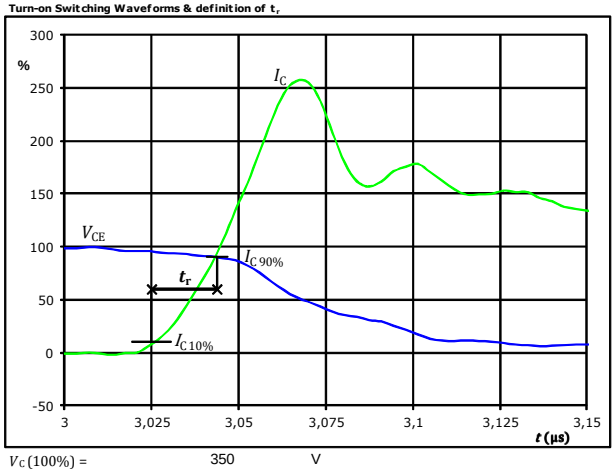
Turn-off Switching Waveforms & definition of t_f



$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	15	A
t_f =	0,093	µs

figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

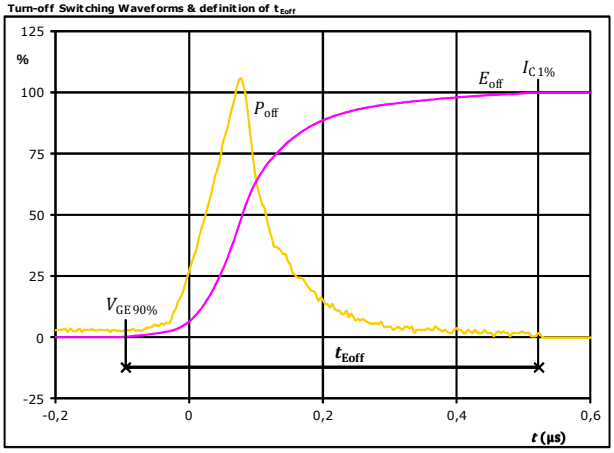


$V_C(100\%)$ =	350	V
$I_C(100\%)$ =	15	A
t_r =	0,018	µs

Boost Switching Characteristics

figure 5. **IGBT**

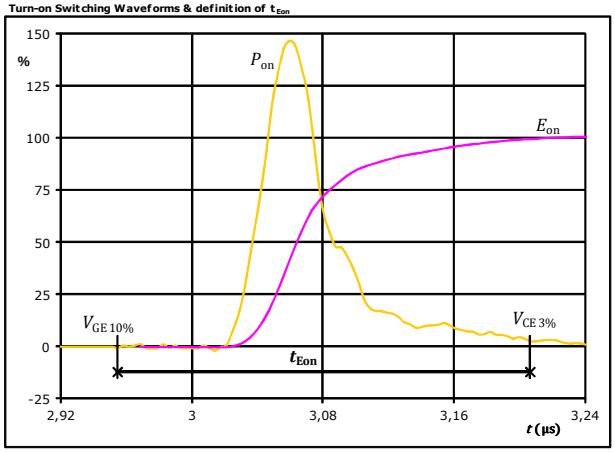
Turn-off Switching Waveforms & definition of t_{Eoff}



$P_{off}(100\%)$ =	5,26	kW
$E_{off}(100\%)$ =	0,65	mJ
t_{Eoff} =	0,62	µs

figure 6. **IGBT**

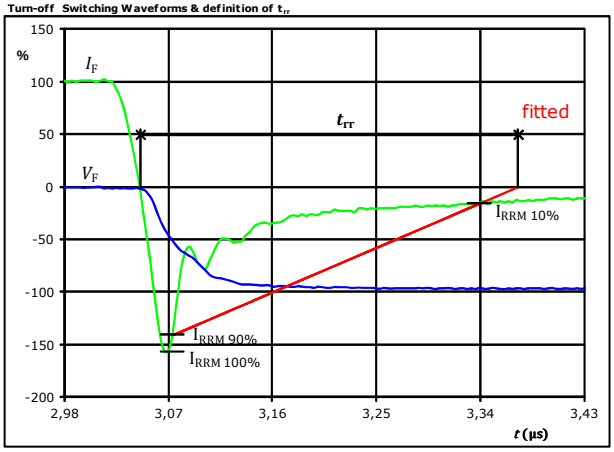
Turn-on Switching Waveforms & definition of t_{Eon}



$P_{on}(100\%)$ =	5,26	kW
$E_{on}(100\%)$ =	0,40	mJ
t_{Eon} =	0,25	µs

figure 7. **FWD**

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

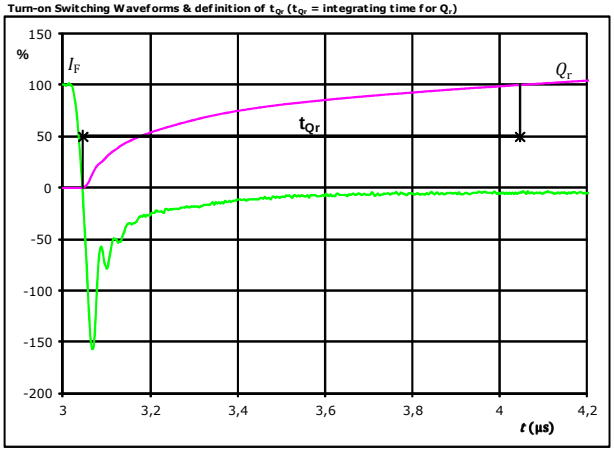


$V_F(100\%)$ =	350	V
$I_F(100\%)$ =	15	A
$I_{RRM}(100\%)$ =	-24	A
t_{rr} =	0,309	µs

Boost Switching Characteristics

figure 8. **FWD**

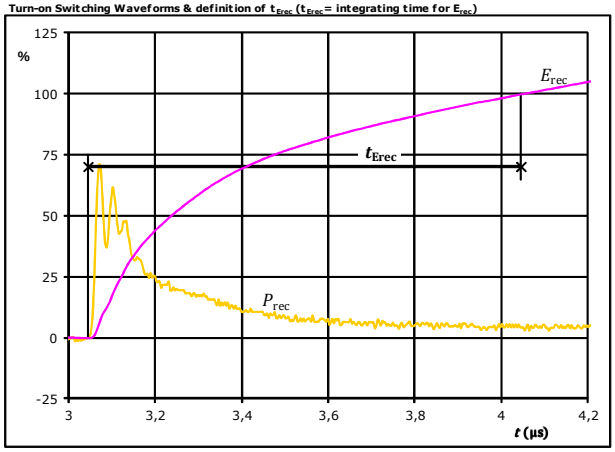
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	15	A
Q_r (100%) =	2,35	µC
t_{Qr} =	1,00	µs

figure 9. **FWD**

Turn-on Switching Waveforms & definition of t_{Erec} (t_{Erec} = integrating time for E_{rec})



P_{rec} (100%) =	5,26	kW
E_{rec} (100%) =	0,64	mJ
t_{Erec} =	1,00	µs

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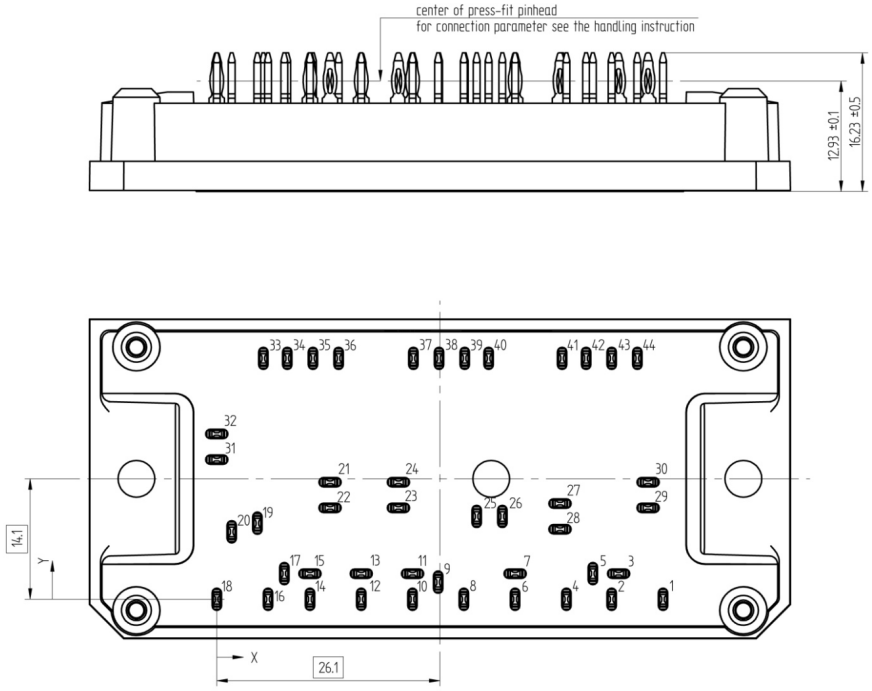
Ordering Code & Marking

Version	Ordering Code
with thermal paste 12 mm housing with press-fit pins	10-PY12M3A025SH04-M746F43Y-/3/

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

Outline

Pin table			
Pin	X	Y	Function
1	52,2	0	+DC
2	46,2	0	GND
3	47	3	G3
4	40,9	0	GND
5	44	3	S3
6	34,9	0	-DC
7	34,9	3	-DC
8	28,9	0	GND
9	25,9	2	S7
10	22,9	0	GND
11	22,9	3	G7
12	16,9	0	+DC
13	16,9	3	+DC
14	10,9	0	GND
15	10,9	3	G11
16	6	0	GND
17	7,9	3	S11
18	0	0	-DC
19	4,75	8,9	S12
20	1,75	7,9	G12
21	13,25	13,7	S10
22	13,25	10,7	G10
23	21,25	10,7	G6
24	21,25	13,7	S6
25	30,4	9,7	S8
26	33,4	9,7	G8
27	40,15	11,2	S4
28	40,15	8,2	G4
29	50,45	10,7	S2
30	50,45	13,7	G2
31	0	16,35	NTC
32	0	19,35	NTC
33	5,45	28,2	OUT3
34	8,25	28,2	OUT3
35	11,25	28,2	G9
36	14,25	28,2	S9
37	23	28,2	S5
38	26	28,2	G5
39	29	28,2	OUT2
40	31,8	28,2	OUT2
41	40,4	28,2	OUT1
42	43,2	28,2	OUT1
43	46,2	28,2	G1
44	49,2	28,2	S1



Tolerance of pinpositions: ±0,5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

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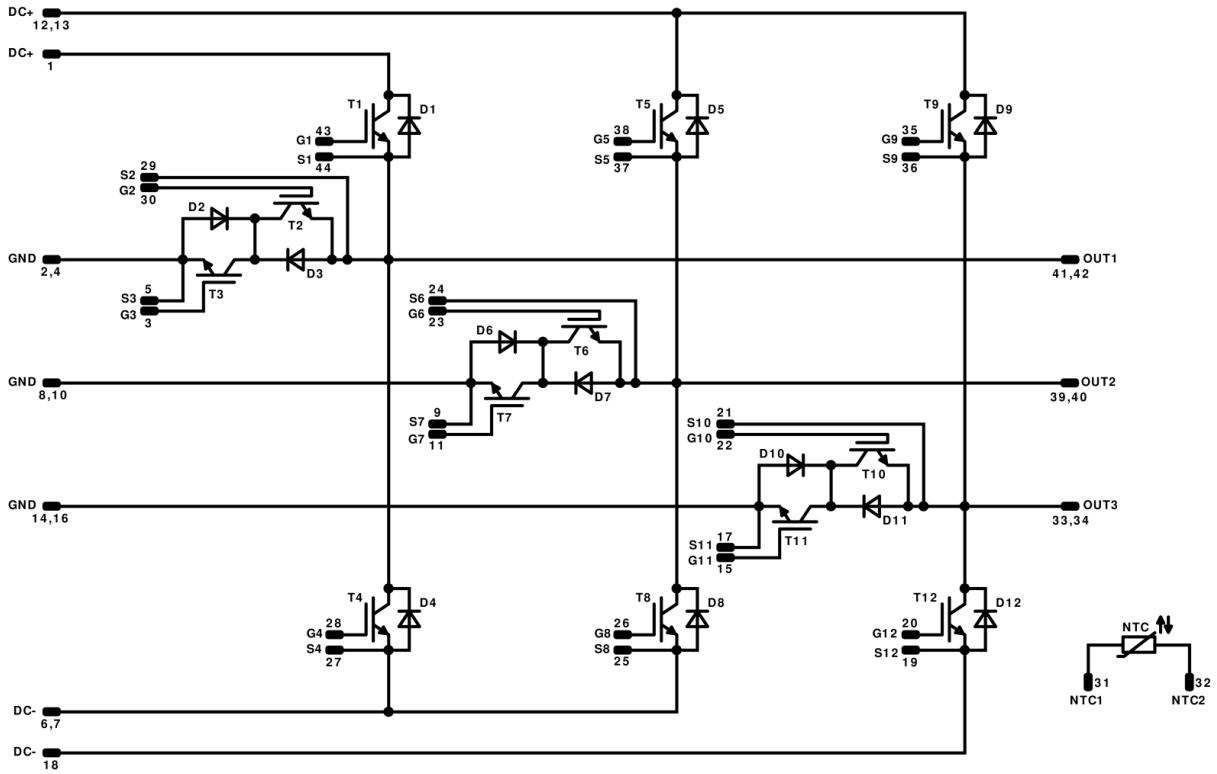
Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T1, T4, T5, T8, T9, T12	IGBT	1200 V	25 A	Buck Switch	
D2, D3, D6, D7, D10, D11	FWD	650 V	20 A	Buck Diode	
T2, T3, T6, T7, T10, T11	IGBT	650 V	20 A	Boost Switch	
D1, D4, D5, D8, D9, D12	FWD	1200 V	15 A	Boost Diode	
NTC	NTC			Thermistor	

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

Handling instruction
Handling instructions for *flow* 1 packages see vincotech.com website.

Package data
Package data for *flow* 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-PY12M3A025SH04-M746F43Y-D1-14	21 Sep. 2017		