Vincotech

B0-SP12VPA025M702-LR28A13T
datasheet

flowPIM S3 + 3xPFC **1200 V / 25 A**

Topology features

- Open Emitter configuration
- Temperature sensor
- Inverter
- 3ph Vienna rectifier

Component features

- Commutation rugged
- Easy to use / drive
- Suitable for hard and soft switching

Housing features

- Base isolation: Al_2O_3
- CTI600 housing material
- Compact, baseplate-less housing
- VINcoPress Technology
- Thermo-mechanical push-and-pull force relief
- Press-fit pin
- Reliable cold welding connection

Target applications

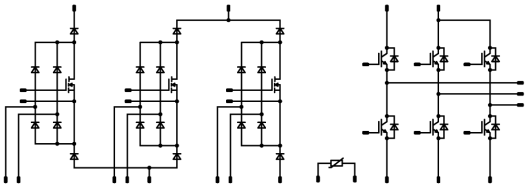
- Embedded Drives
- Heat Pumps
- HVAC
- Industrial Drives

Types

- B0-SP12VPA025M702-LR28A13T

flow S3 12 mm housing

Schematic



Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Inverter Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ T_s = 80 °C	36	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	50	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	89	W
Gate-emitter voltage	V_{GES}		±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V, V_{CC} = 800 V T_j = 150 °C	9,5	µs
Maximum junction temperature	T_{jmax}		175	°C
Inverter Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ T_s = 80 °C	32	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	50	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	61	W
Maximum junction temperature	T_{jmax}		175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Boost Switch					
Drain-source voltage	V_{DSS}			600	V
Drain current (DC current)	I_D	T_j = T_{jmax}	T_s = 80 °C	23	A
Peak drain current	I_{DM}	t_p limited by T_{jmax}		151	A
Avalanche energy, single pulse	E_{AS}	V_{DD} = 50 V	I_D = 0 A	159	mJ
Avalanche energy, repetitive	E_{AR}	V_{DD} = 50 V	I_D = 0 A	0,8	mJ
MOSFET dv/dt ruggedness	dv/dt	V_{DS}= 0..400 V	T_s = 25 °C	80	V/ns
Total power dissipation	P_{tot}	T_j = T_{jmax}	T_s = 80 °C	70	W
Gate-source voltage	V_{GSS}	static		±20	V
Reverse diode dv/dt	dv/dt			50	V/ns
Maximum Junction Temperature	T_{jmax}			150	°C
Boost Diode					
Peak repetitive reverse voltage	V_{RRM}			650	V
Forward current (DC current)	I_F	T_j = T_{jmax}	T_s = 80 °C	36	A
Total power dissipation	P_{tot}	T_j = T_{jmax}	T_s = 80 °C	58	W
Maximum junction temperature	T_{jmax}			175	°C
Negative Boost Diode					
Peak repetitive reverse voltage	V_{RRM}			650	V
Forward current (DC current)	I_F	T_j = T_{jmax}	T_s = 80 °C	36	A
Total power dissipation	P_{tot}	T_j = T_{jmax}	T_s = 80 °C	58	W
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Rectifier Diode				
Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	T_j = T_{jmax}, T_s = 80 °C	44	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms, T_j = 150 °C	230	A
Surge current capability	I^2t		260	A^2s
Total power dissipation	P_{tot}	T_j = T_{jmax}, T_s = 80 °C	63	W
Maximum junction temperature	T_{jmax}		150	°C
Module Properties				
Thermal Properties				
Storage temperature	T_{stg}		-40…+125	°C
Operation temperature under switching condition	T_{jop}		-40…+(T_{jmax} - 25)	°C
Isolation Properties				
Isolation voltage	V_{isol}	DC Test Voltage* t_p = 2 s	6800	V
Creepage distance			9,87	mm
Clearance			7,99	mm
Comparative Tracking Index	CTI		≥ 600	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$			10	0,0025	25	5,4	6	6,6	V
Collector-emitter saturation voltage	V_{CEsat}		15		25	25 125 150		1,64 1,89 1,95	2,1(1)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			70	µA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}		0	10		25		4800		pF
Output capacitance	C_{oes}							170		pF
Reverse transfer capacitance	C_{res}							57		pF
Gate charge	Q_g	V_{CC} = 600 V	0/15		25	25		180		nC
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						1,06		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 16 Ω R_{goff} = 16 Ω	±15	600	25	25 125 150		163,52 160,64 159,68		ns
Rise time	t_r					25 125 150		41,92 47,36 47,68		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		169,6 193,92 200,96		ns
Fall time	t_f					25 125 150		100,02 125,44 129,58		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=2,23 µC Q_{rFWD}=3,53 µC Q_{rFWD}=3,96 µC				25 125 150		2,18 2,85 3		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		1,62 2,3 2,49		mWs

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Inverter Diode										
Static										
Forward voltage	V_F				25	25 125 150		1,63 1,7 1,69	2,1(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25			35	µA
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						1,55		K/W
Dynamic										
Peak recovery current	I_{RM}	di/dt=464 A/µs di/dt=417 A/µs di/dt=409 A/µs	±15	600	25	25 125 150		17,98 19,68 20,33		A
Reverse recovery time	t_{rr}					25 125 150		246,56 369,18 411,23		ns
Recovered charge	Q_r					25 125 150		2,23 3,53 3,96		µC
Reverse recovered energy	E_{rec}					25 125 150		0,765 1,3 1,48		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		163,44 106,12 100,3		A/µs

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Boost Switch										
Static										
Drain-source on-state resistance	$r_{DS(on)}$		10		15,9	25 125		63,3 115	60(1)	mΩ
Gate-source threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$			0,0008	25	3	3,5	4	V
Gate to Source Leakage Current	I_{GSS}		20	0		25			100	nA
Zero Gate Voltage Drain Current	I_{DSS}		0	600		25			1	µA
Internal gate resistance	r_g							2,8		Ω
Gate charge	Q_g		0/10	400	15,9	25		67		nC
Short-circuit input capacitance	C_{iss}	f = 250 kHz	0	400	0	25		2895		pF
Short-circuit output capacitance	C_{oss}							48		
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						1		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 16 Ω R_{goff} = 16 Ω	0/10	400	20	25 125		40,99 37,27		ns
Rise time	t_r					25 125		13,75 14,57		ns
Turn-off delay time	$t_{d(off)}$					25 125		172,72 189,04		ns
Fall time	t_f					25 125		14,7 13,41		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,408 µC Q_{rFWD}=1,14 µC				25 125		0,193 0,39		mWs
Turn-off energy (per pulse)	E_{off}					25 125		0,131 0,152		mWs

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Boost Diode										
Static										
Forward voltage	V_F				30	25 125 150		2,33 1,76 1,65	3[1]	V
Reverse leakage current	I_R	V_r = 650 V				25			7	µA
Thermal										
Thermal resistance junction to sink[2]	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						1,63		K/W
Dynamic										
Peak recovery current	I_{RM}	di/dt=1747 A/µs di/dt=1422 A/µs	0/10	400	20	25 125		23,21 35,98		A
Reverse recovery time	t_{rr}					25 125		32,8 52,82		ns
Recovered charge	Q_r					25 125		0,408 1,14		µC
Reverse recovered energy	E_{rec}					25 125		0,101 0,269		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		1138,77 1436,3		A/µs

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Negative Boost Diode										
Static										
Forward voltage	V_F				30	25 125 150		2,33 1,76 1,65	3(1)	V
Reverse leakage current	I_R	V_r = 650 V				25			7	µA
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						1,63		K/W
Dynamic										
Peak recovery current	I_{RM}	di/dt=1747 A/µs di/dt=1422 A/µs	0/10	400	20	25 125		23,21 35,98		A
Reverse recovery time	t_{rr}					25 125		32,8 52,82		ns
Recovered charge	Q_r					25 125		0,408 1,14		µC
Reverse recovered energy	E_{rec}					25 125		0,101 0,269		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		1138,77 1436,3		A/µs

Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Rectifier Diode										
Static										
Forward voltage	V_F				30	25 125		1,25 1,24	1,29(1) 1,31(1)	V
Reverse leakage current	I_R	V_r = 1600 V				25 150			10 1	µA mA
Thermal										
Thermal resistance junction to sink(2)	$R_{th(j-s)}$	λ_{paste} = 5,2 W/mK (PTM)						1,11		K/W
Thermistor										
Static										
Rated resistance	R					25		22		kΩ
Deviation of R100	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P					25		130		mW
Power dissipation constant	d					25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %						3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %						4000		K
Vincotech Thermistor Reference									I	

(1) Value at chip level

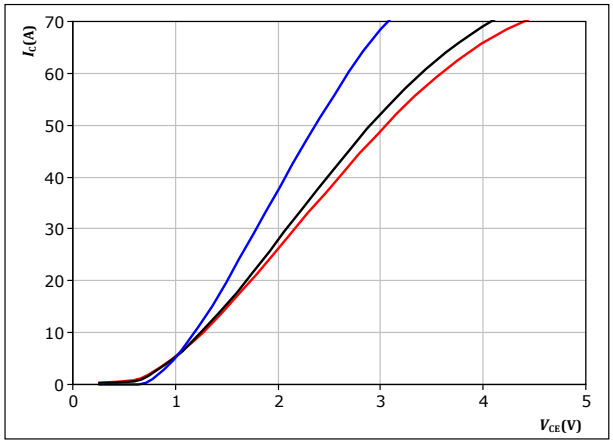
(2) Only valid with pre-applied Vincotech thermal interface material.

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

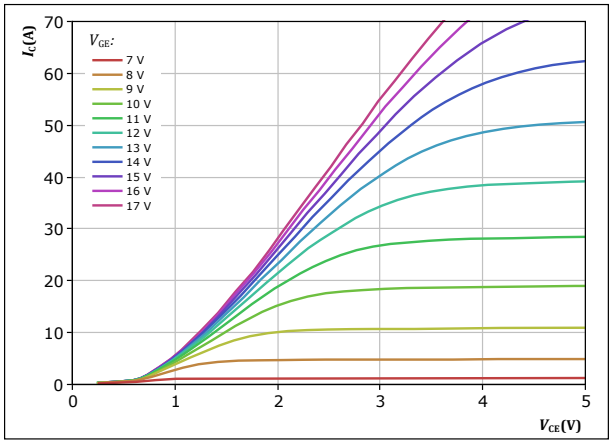


t_p =	250	µs		
V_{GE} =	15	V	T_j:	25 °C
				125 °C
				150 °C

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$



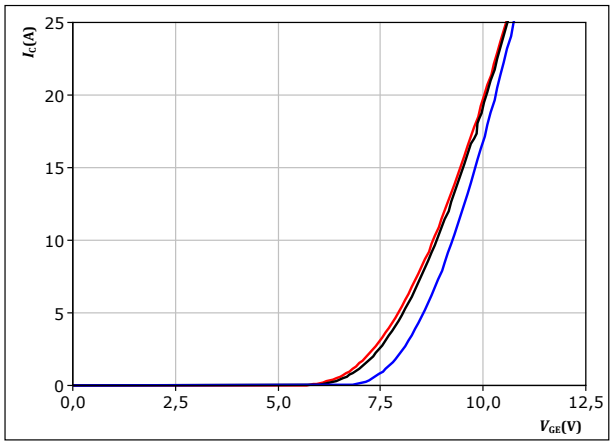
t_p =	250	µs
T_j =	150	°C

V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

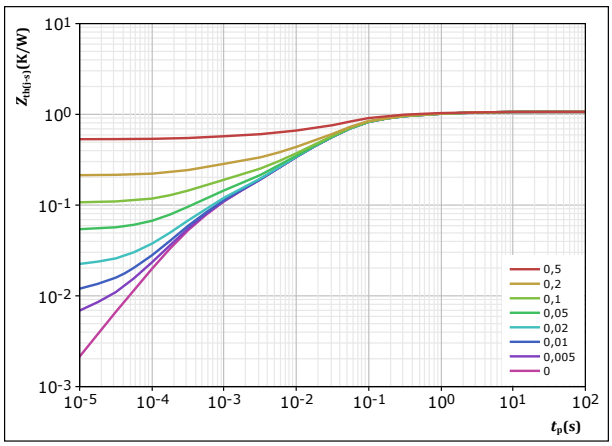


t_p =	250	µs		
V_{CE} =	10	V	T_j:	25 °C
				125 °C
				150 °C

figure 4. **IGBT**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	1,064	K/W

IGBT thermal model values

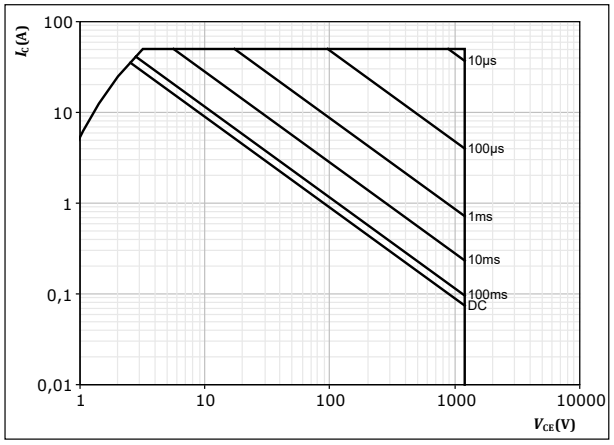
R (K/W)	τ (s)
7,43E-02	2,04E+00
1,91E-01	2,18E-01
5,73E-01	4,01E-02
1,48E-01	5,24E-03
7,80E-02	4,52E-04

Inverter Switch Characteristics

figure 5. **IGBT**

Safe operating area

$I_C = f(V_{CE})$

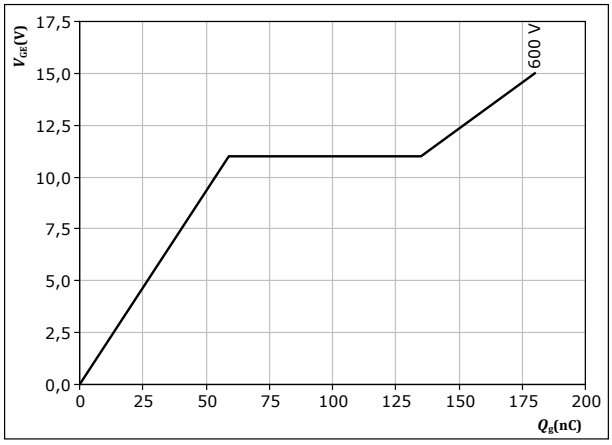


D = single pulse
T_s = 80 °C
V_{GE} = 15 V
T_j = T_{jmax}

figure 6. **IGBT**

Gate voltage vs gate charge

$V_{GE} = f(Q_g)$



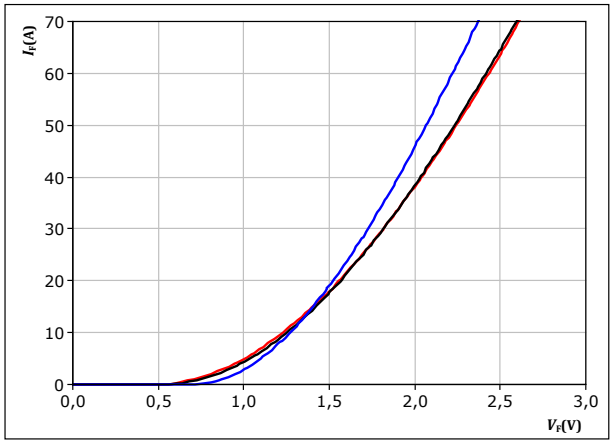
I_C = 25 A
T_j = 25 °C

Inverter Diode Characteristics

figure 7. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



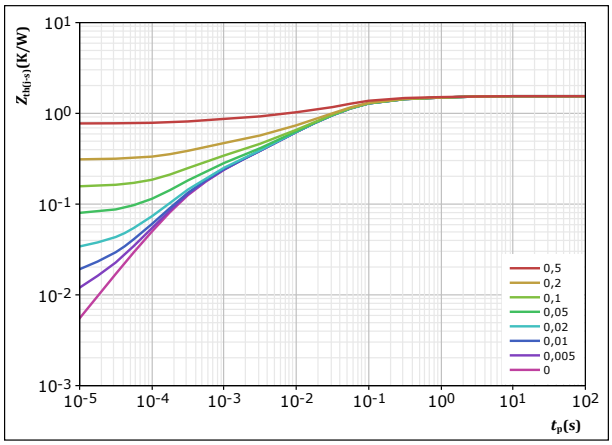
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 8. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,546 K/W

FWD thermal model values

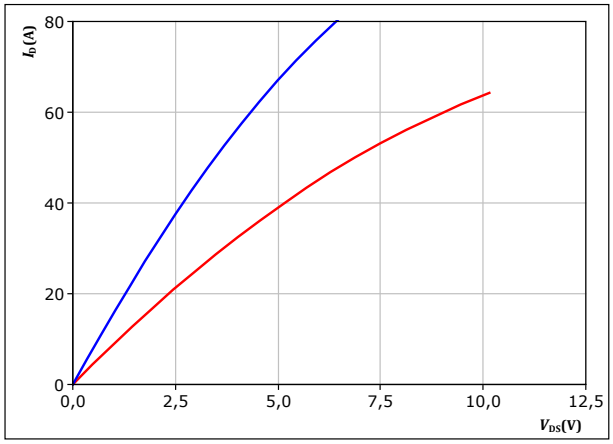
R (K/W)	τ (s)
1,04E-01	1,45E+00
2,93E-01	1,31E-01
7,45E-01	3,01E-02
2,42E-01	3,52E-03
1,62E-01	3,50E-04

Boost Switch Characteristics

figure 9. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$

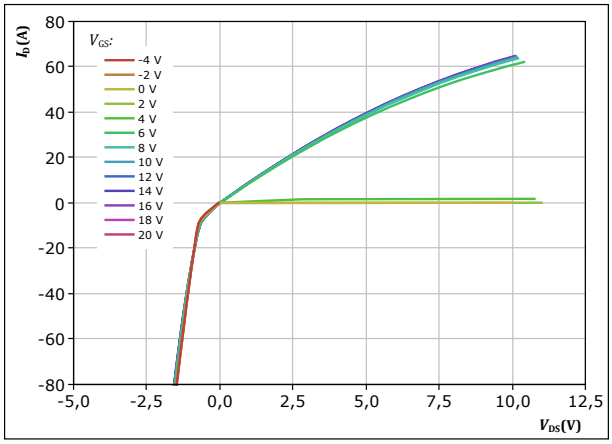


t_p =	250	µs	T_j:	25 °C
V_{GS} =	10	V		125 °C

figure 10. **MOSFET**

Typical output characteristics

$I_D = f(V_{DS})$



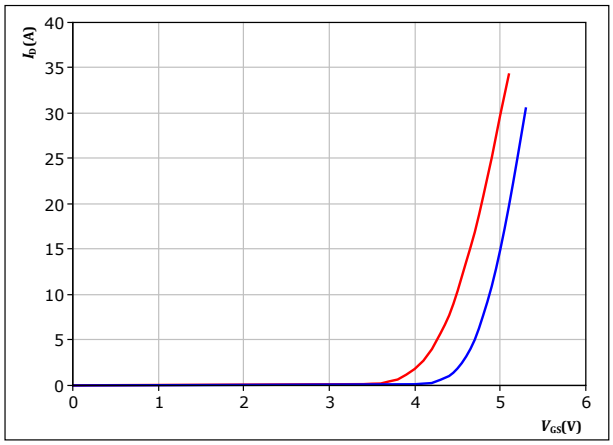
t_p =	250	µs
T_j =	125	°C

V_{GS} from -4 V to 20 V in steps of 2 V

figure 11. **MOSFET**

Typical transfer characteristics

$I_D = f(V_{GS})$

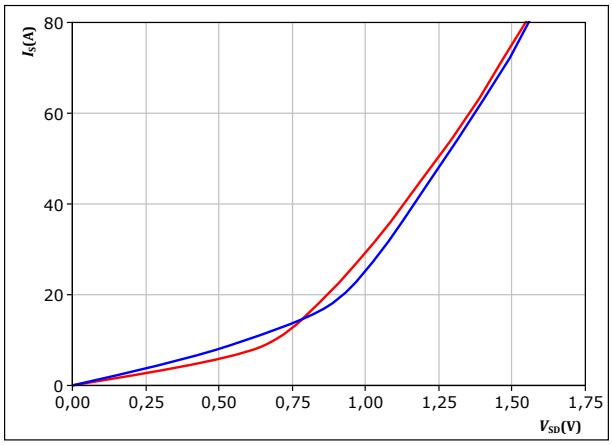


t_p =	250	µs	T_j:	25 °C
V_{DS} =	10	V		125 °C

figure 12. **MOSFET**

Typical reverse drain current characteristics

$I_{SD} = f(V_{SD})$



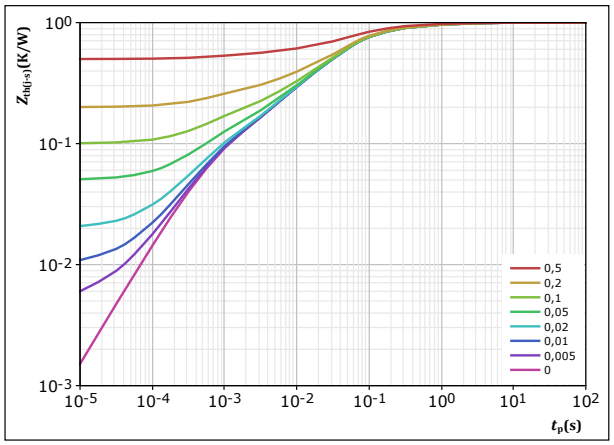
t_p =	250	µs	T_j:	25 °C
V_{GS} =	10	V		125 °C

Boost Switch Characteristics

figure 13. **MOSFET**

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	K/W

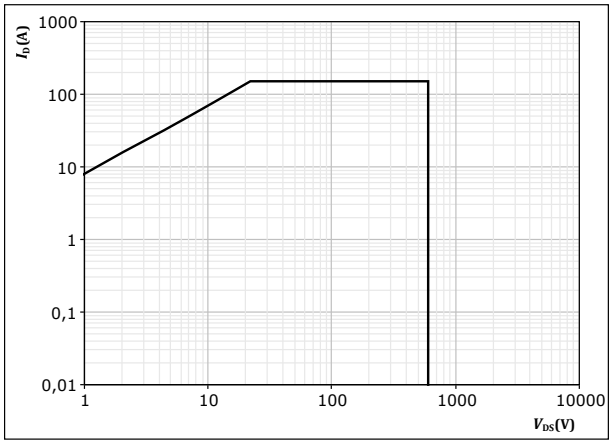
MOSFET thermal model values

R (K/W)	τ (s)
6,37E-02	1,67E+00
1,67E-01	2,31E-01
5,49E-01	4,89E-02
1,43E-01	7,12E-03
7,78E-02	6,47E-04

figure 14. **MOSFET**

Safe operating area

$I_D = f(V_{DS})$



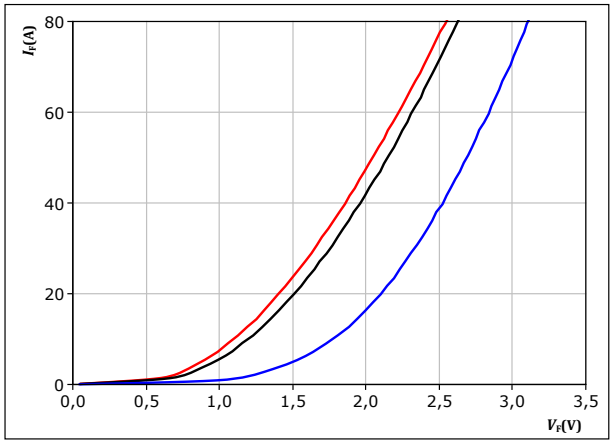
D =	single pulse	
T_s =	80	°C
V_{GS} =	10	V
T_j =	T_{jmax}	

Boost Diode Characteristics

figure 15. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



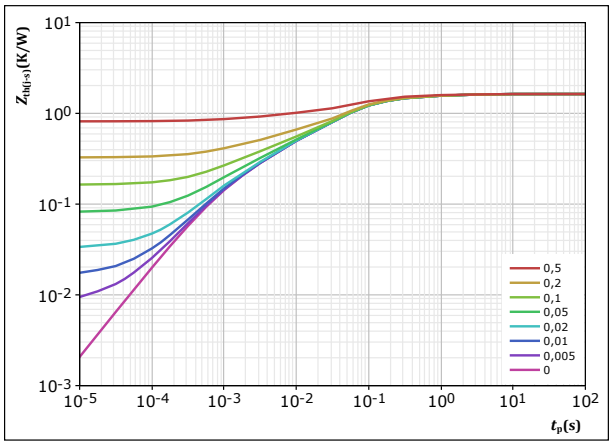
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 16. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,633 K/W

FWD thermal model values

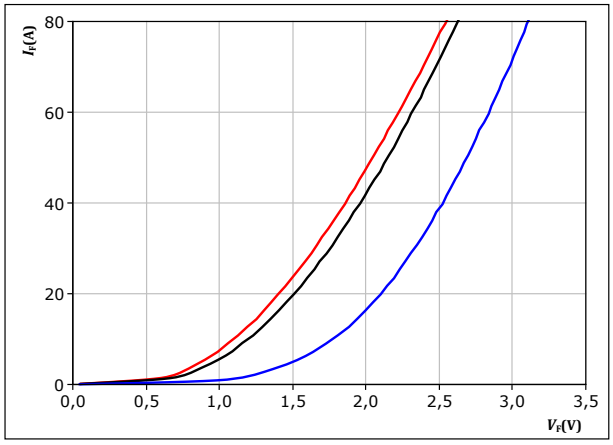
R (K/W)	τ (s)
1,04E-01	1,98E+00
2,66E-01	2,44E-01
8,96E-01	5,30E-02
2,60E-01	4,95E-03
1,07E-01	7,81E-04

Negative Boost Diode Characteristics

figure 17. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



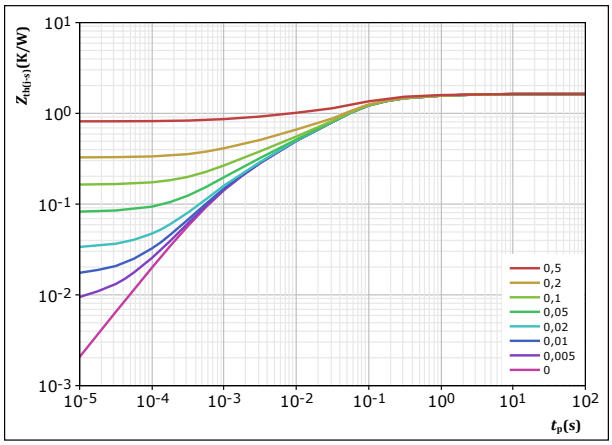
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 18. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,633 K/W

FWD thermal model values

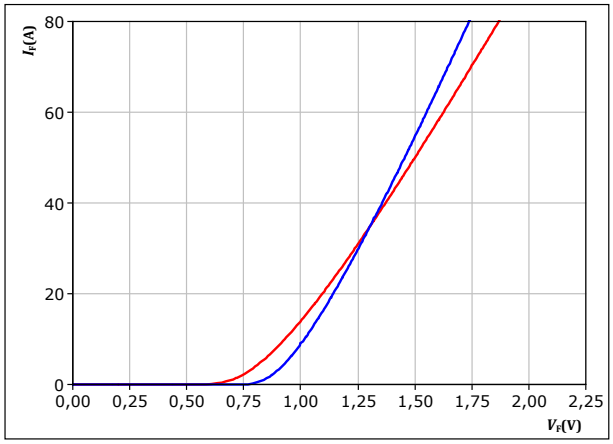
R (K/W)	τ (s)
1,04E-01	1,98E+00
2,66E-01	2,44E-01
8,96E-01	5,30E-02
2,60E-01	4,95E-03
1,07E-01	7,81E-04

Rectifier Diode Characteristics

figure 19. **Rectifier**

Typical forward characteristics

$I_F = f(V_F)$



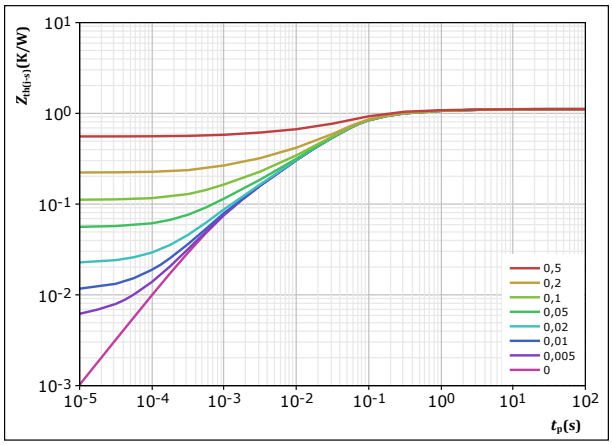
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 20. **Rectifier**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,113 K/W

Rectifier thermal model values

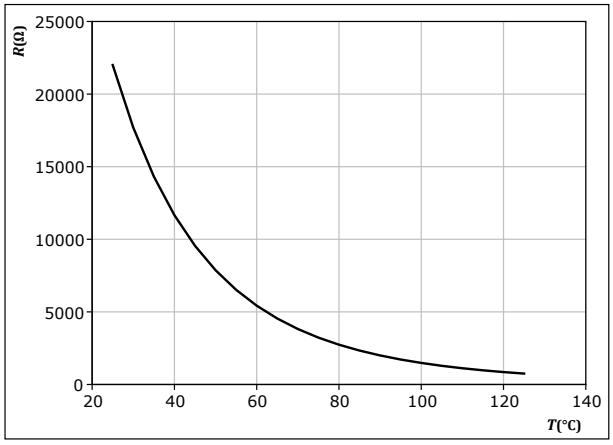
R (K/W)	τ (s)
5,54E-02	2,93E+00
1,47E-01	3,46E-01
6,70E-01	5,55E-02
1,72E-01	8,20E-03
6,87E-02	9,95E-04

Thermistor Characteristics

figure 21. **Thermistor**

Typical NTC characteristic as function of temperature

$R_T = f(T)$

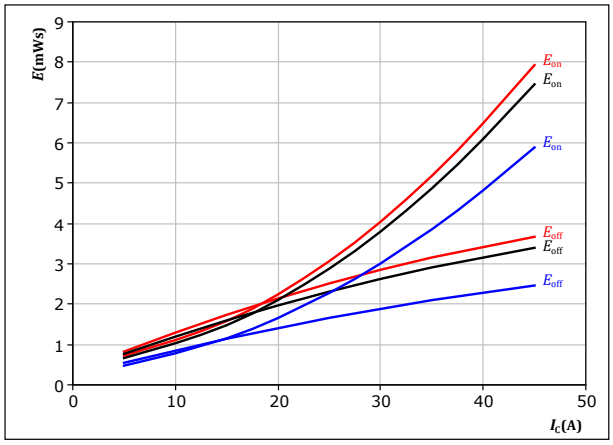


Inverter Switching Characteristics

figure 22. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



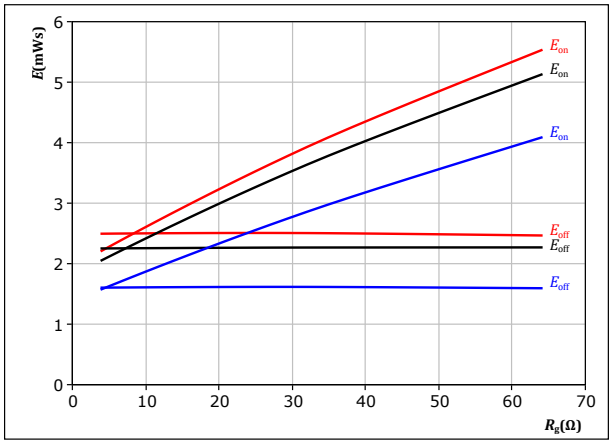
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		150 °C
R_{goff} =	16	Ω		

figure 23. **IGBT**

Typical switching energy losses as a function of IGBT turn on gate resistor

$E = f(R_g)$



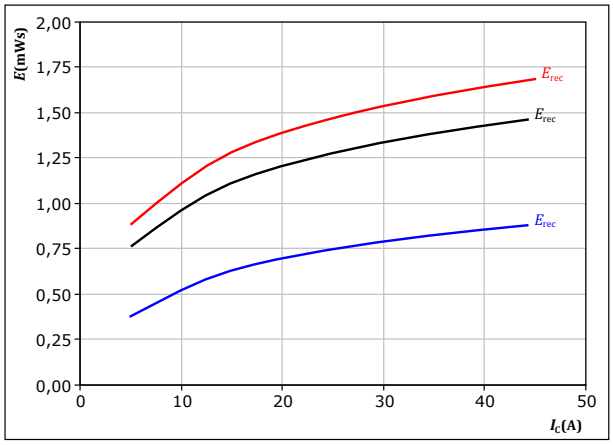
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	25	A		150 °C

figure 24. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



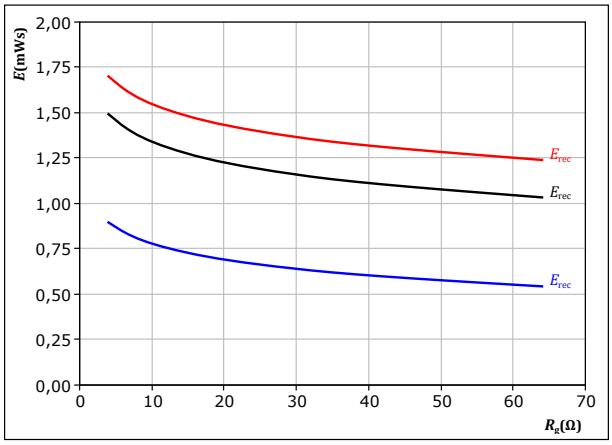
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 25. **FWD**

Typical reverse recovered energy loss as a function of IGBT turn on gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

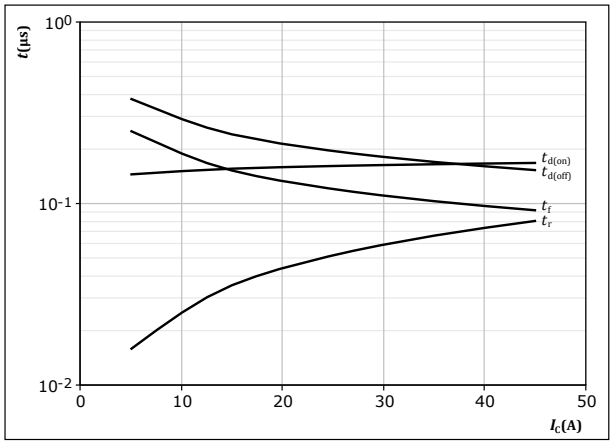
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	25	A		150 °C

Inverter Switching Characteristics

figure 26. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



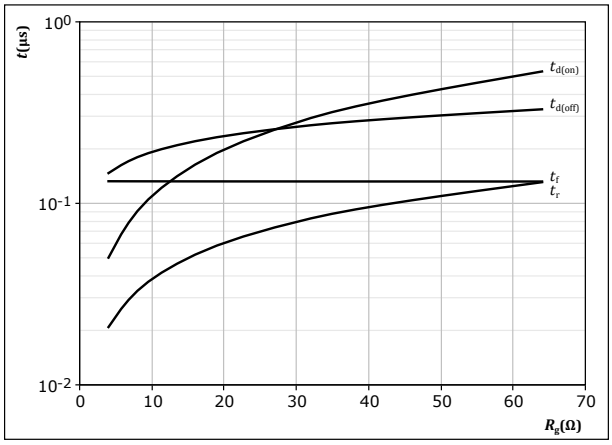
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 27. **IGBT**

Typical switching times as a function of IGBT turn on gate resistor

$t = f(R_g)$



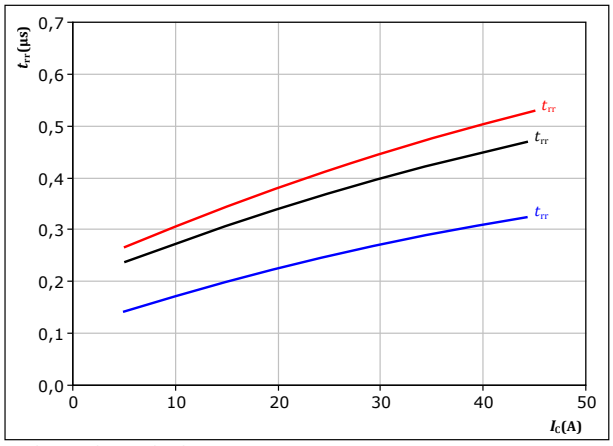
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	25	A

figure 28. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



With an inductive load at

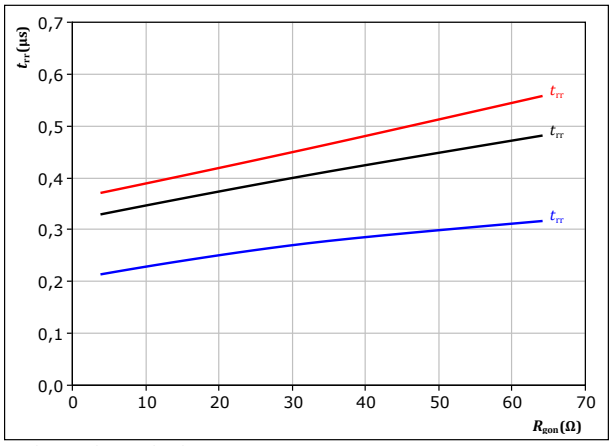
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 29. **FWD**

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

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



With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	25	A

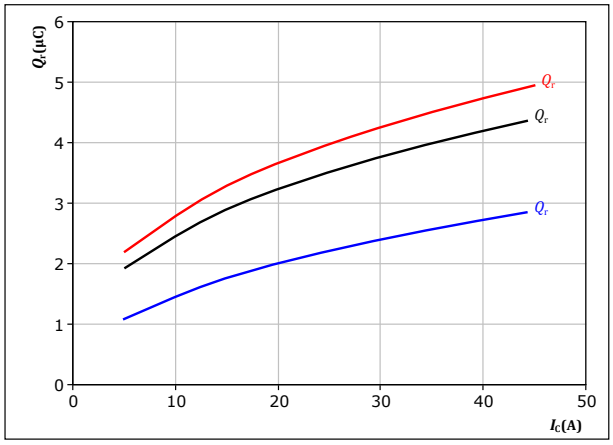
T_j: 25 °C, 125 °C, 150 °C

Inverter Switching Characteristics

figure 30. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$



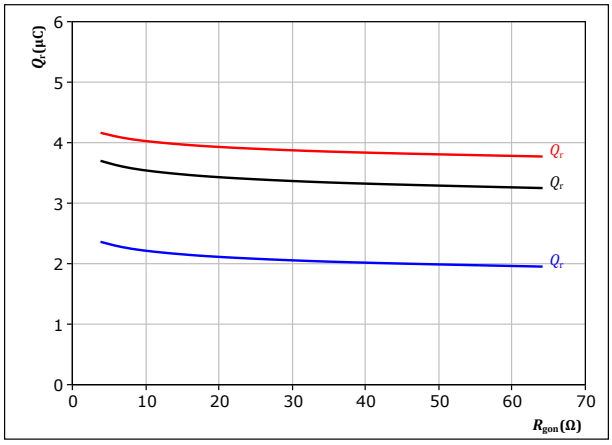
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 31. **FWD**

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

$Q_r = f(R_{gon})$



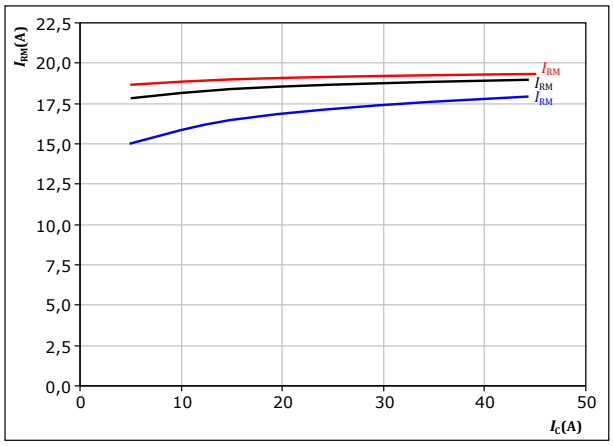
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	25	A		150 °C

figure 32. **FWD**

Typical peak reverse recovery current as a function of collector current

$I_{RM} = f(I_C)$



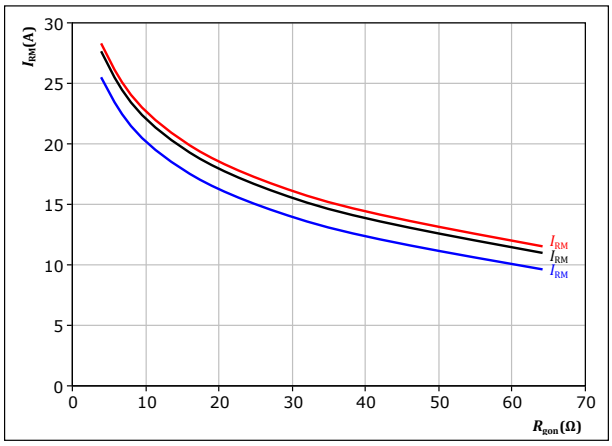
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 33. **FWD**

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

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



With an inductive load at

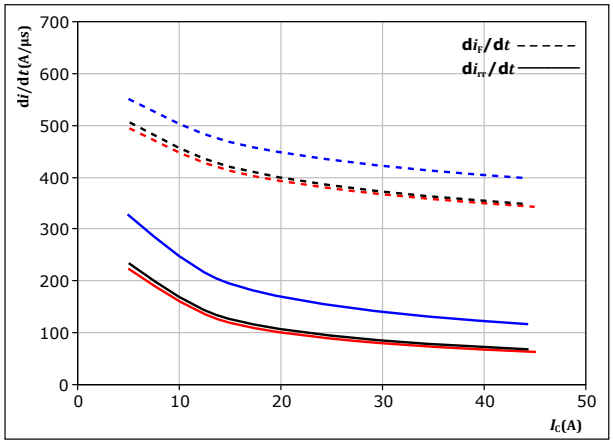
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	25	A		150 °C

Inverter Switching Characteristics

figure 34. **FWD**

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

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



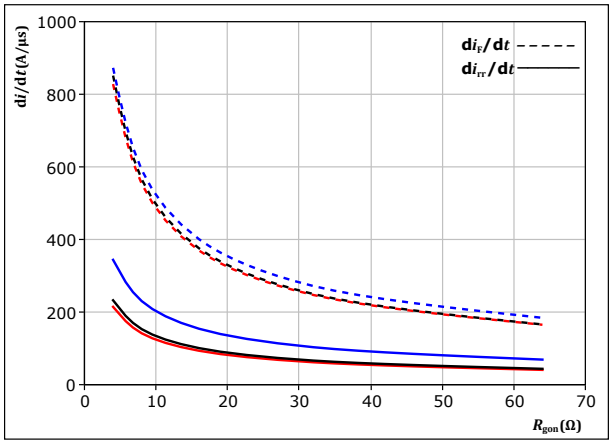
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 35. **FWD**

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

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



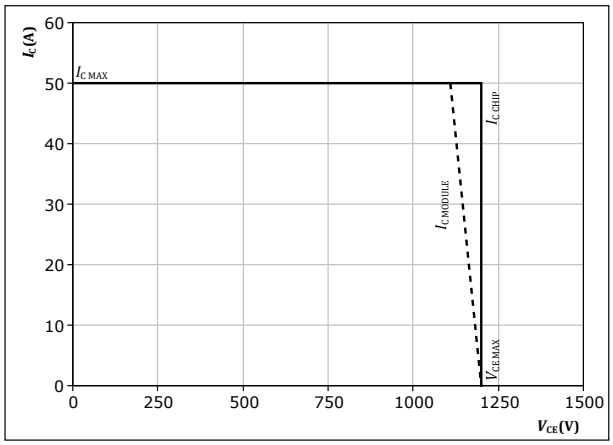
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	25	A		150 °C

figure 36. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At

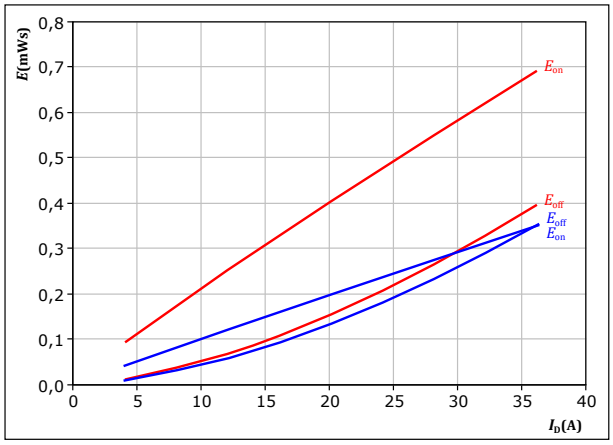
T_j =	150	°C	
R_{gon} =	16	Ω	
R_{goff} =	16	Ω	

Boost Switching Characteristics

figure 37. **MOSFET**

Typical switching energy losses as a function of drain current

$E = f(I_D)$



With an inductive load at

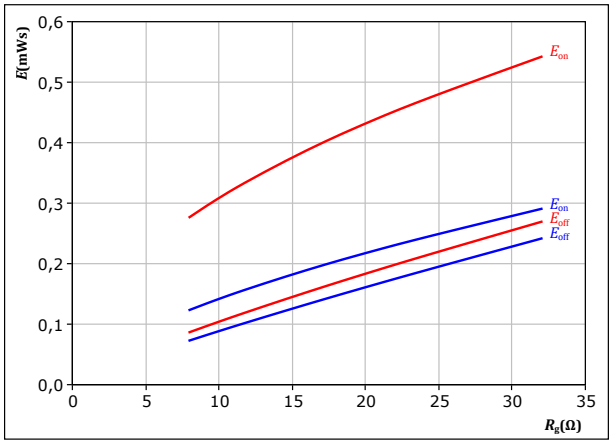
V_{DS} =	400	V
V_{GS} =	0/10	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

T_j: 25 °C, 125 °C

figure 38. **MOSFET**

Typical switching energy losses as a function of MOSFET turn on gate resistor

$E = f(R_g)$



With an inductive load at

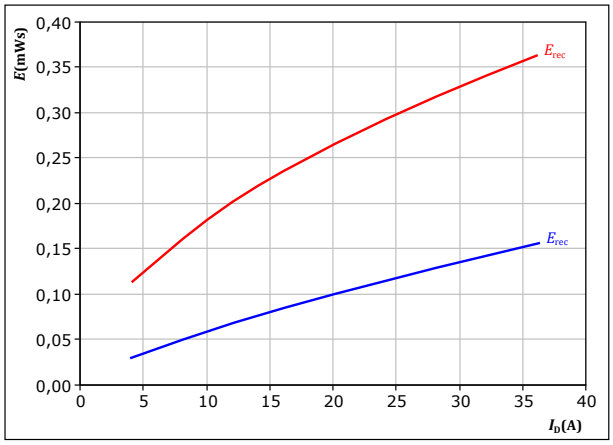
V_{DS} =	400	V
V_{GS} =	0/10	V
I_D =	20	A

T_j: 25 °C, 125 °C

figure 39. **FWD**

Typical reverse recovered energy loss as a function of drain current

$E_{rec} = f(I_D)$



With an inductive load at

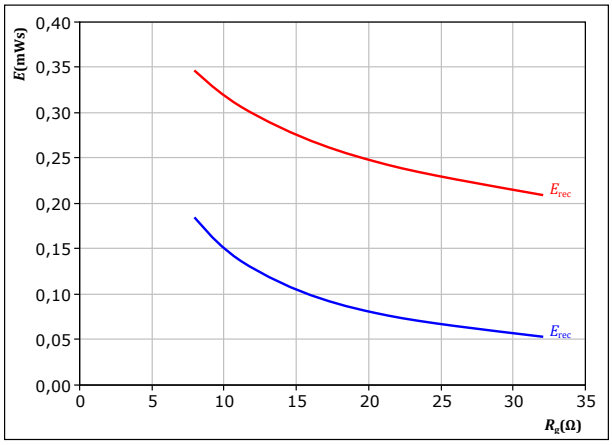
V_{DS} =	400	V
V_{GS} =	0/10	V
R_{gon} =	16	Ω

T_j: 25 °C, 125 °C

figure 40. **FWD**

Typical reverse recovered energy loss as a function of MOSFET turn on gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

V_{DS} =	400	V
V_{GS} =	0/10	V
I_D =	20	A

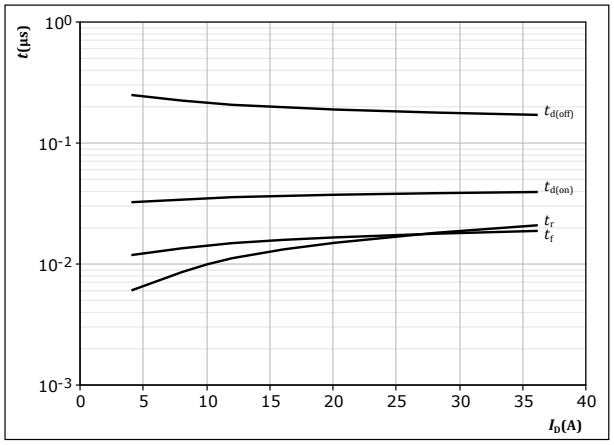
T_j: 25 °C, 125 °C

Boost Switching Characteristics

figure 41. **MOSFET**

Typical switching times as a function of drain current

$t = f(I_D)$



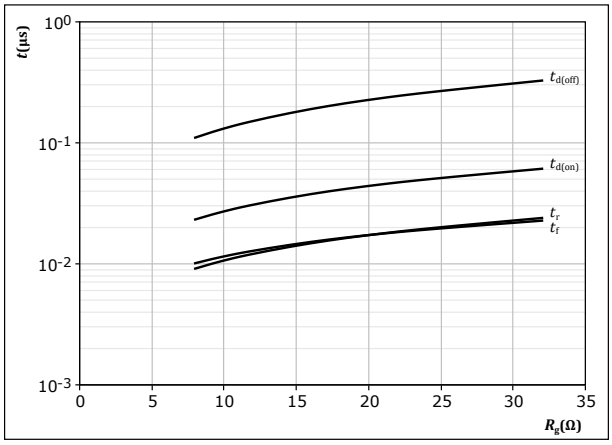
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	0/10	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 42. **MOSFET**

Typical switching times as a function of MOSFET turn on gate resistor

$t = f(R_g)$



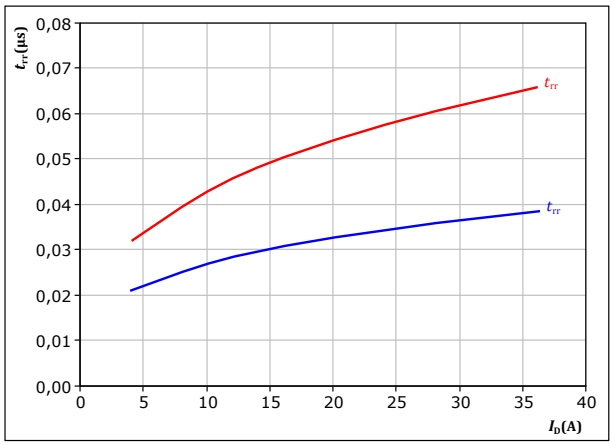
With an inductive load at

T_j =	125	°C
V_{DS} =	400	V
V_{GS} =	0/10	V
I_D =	20	A

figure 43. **FWD**

Typical reverse recovery time as a function of drain current

$t_{rr} = f(I_D)$



At

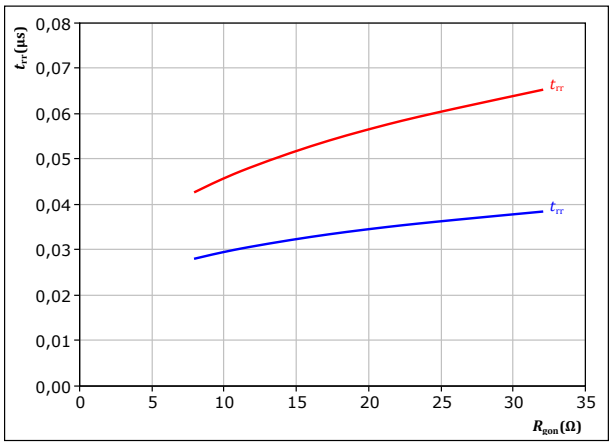
V_{DS} =	400	V
V_{GS} =	0/10	V
R_{gon} =	16	Ω

T_j: 25 °C, 125 °C

figure 44. **FWD**

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

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



At

V_{DS} =	400	V
V_{GS} =	0/10	V
I_D =	20	A

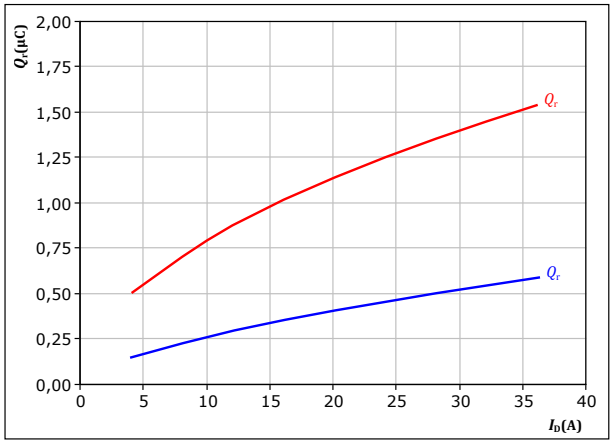
T_j: 25 °C, 125 °C

Boost Switching Characteristics

figure 45. **FWD**

Typical recovered charge as a function of drain current

$Q_r = f(I_D)$

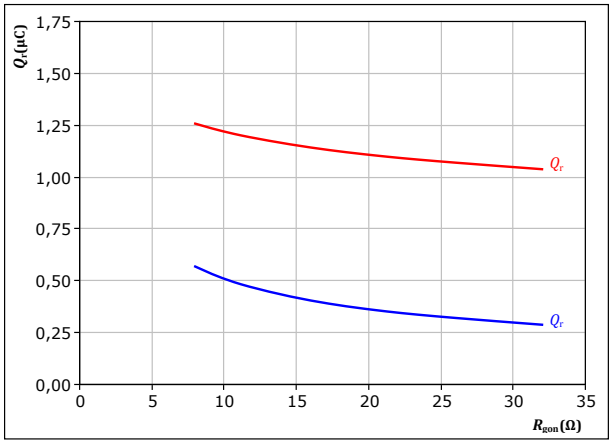


At				T_j:	
	V_{DS} =	400	V		25 °C
	V_{GS} =	0/10	V		125 °C
	R_{gon} =	16	Ω		

figure 46. **FWD**

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

$Q_r = f(R_{gon})$

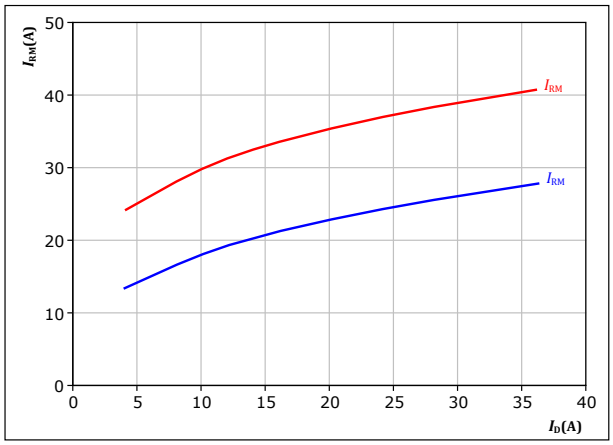


At				T_j:	
	V_{DS} =	400	V		25 °C
	V_{GS} =	0/10	V		125 °C
	I_D =	20	A		

figure 47. **FWD**

Typical peak reverse recovery current as a function of drain current

$I_{RM} = f(I_D)$

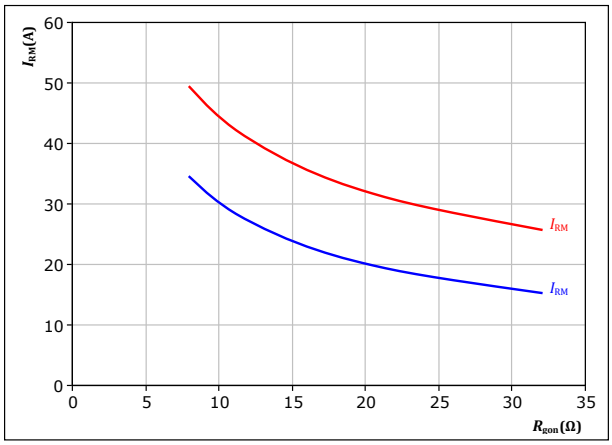


At				T_j:	
	V_{DS} =	400	V		25 °C
	V_{GS} =	0/10	V		125 °C
	R_{gon} =	16	Ω		

figure 48. **FWD**

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

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



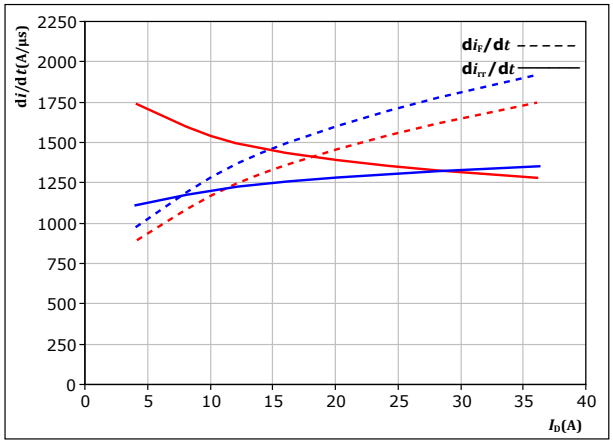
At				T_j:	
	V_{DS} =	400	V		25 °C
	V_{GS} =	0/10	V		125 °C
	I_D =	20	A		

Boost Switching Characteristics

figure 49. **FWD**

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

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



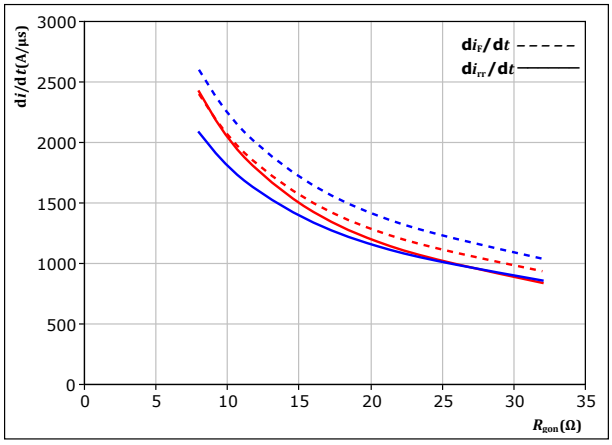
At			
	V_{DS} =	400	V
	V_{GS} =	0/10	V
	R_{gon} =	16	Ω

T_j: 25 °C, 125 °C

figure 50. **FWD**

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

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



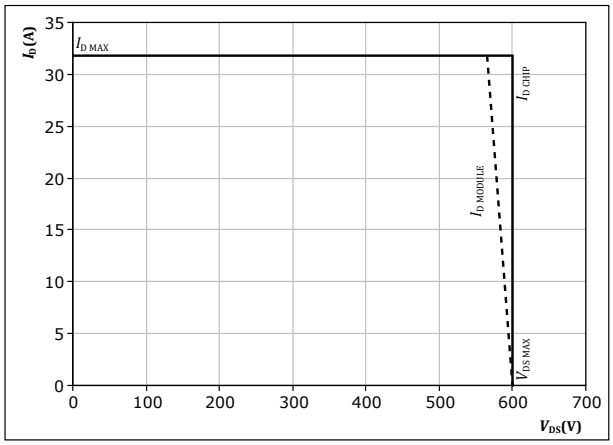
At			
	V_{DS} =	400	V
	V_{GS} =	0/10	V
	I_D =	20	A

T_j: 25 °C, 125 °C

figure 51. **MOSFET**

Reverse bias safe operating area

I_D = f(V_{DS})



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

Inverter Switching Definitions

figure 52. **IGBT**

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

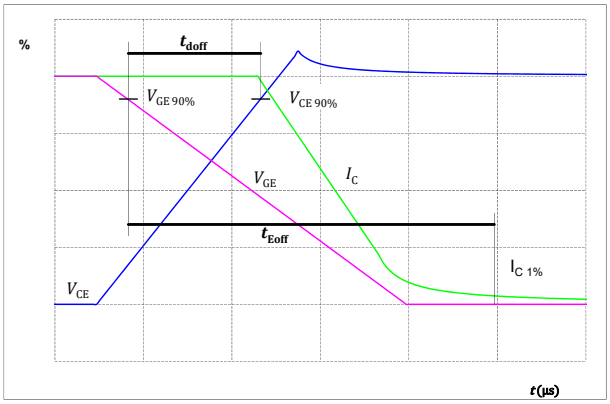


figure 53. **IGBT**

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

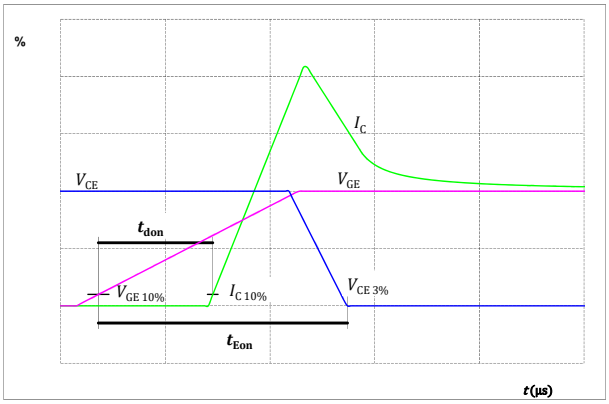


figure 54. **IGBT**

Turn-off Switching Waveforms & definition of t_f

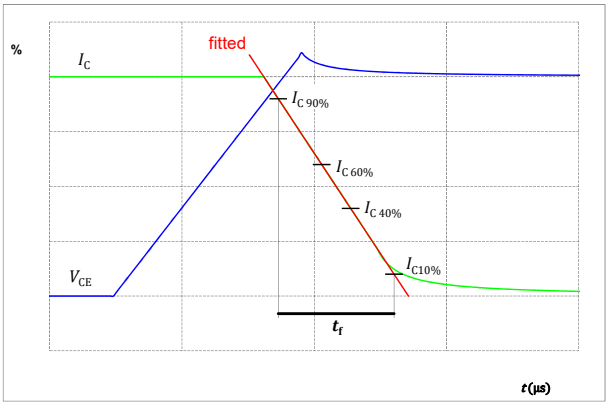
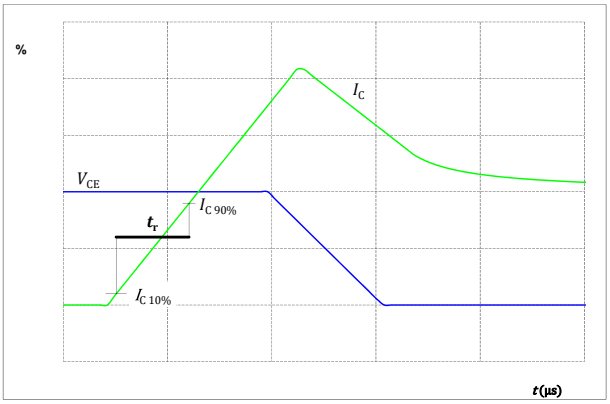


figure 55. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Inverter Switching Definitions

figure 56. **FWD**

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

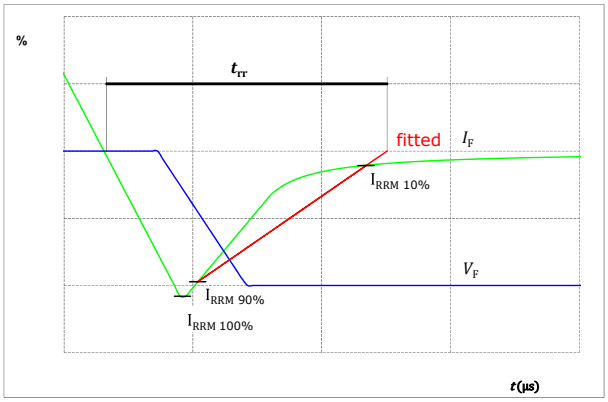
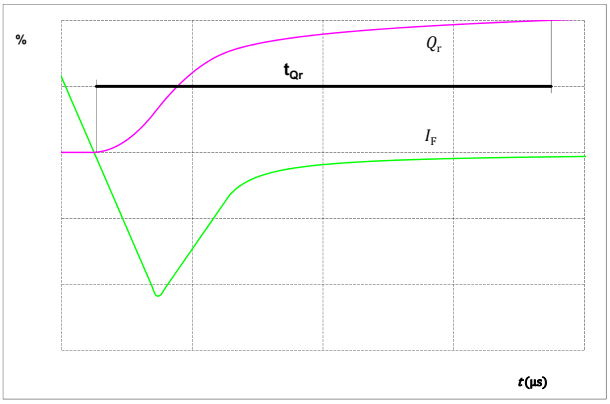


figure 57. **FWD**

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



Boost Switching Definitions

figure 52. MOSFET

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

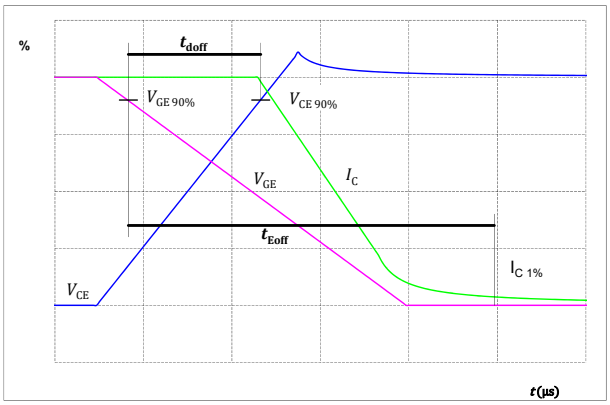


figure 53. MOSFET

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

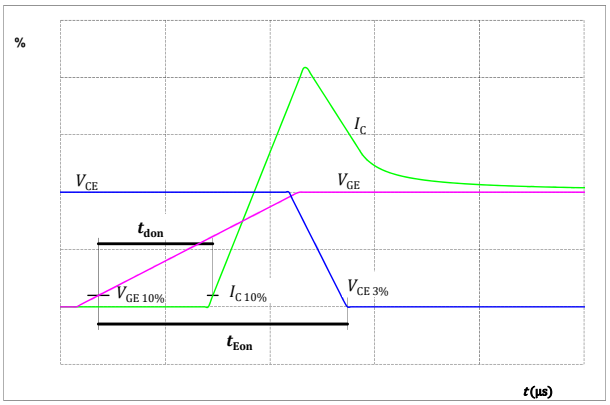


figure 54. MOSFET

Turn-off Switching Waveforms & definition of t_f

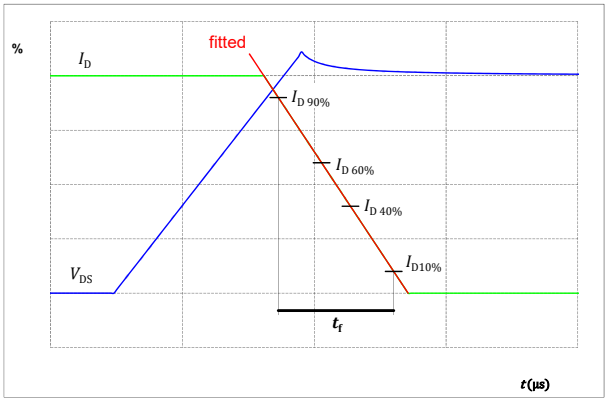
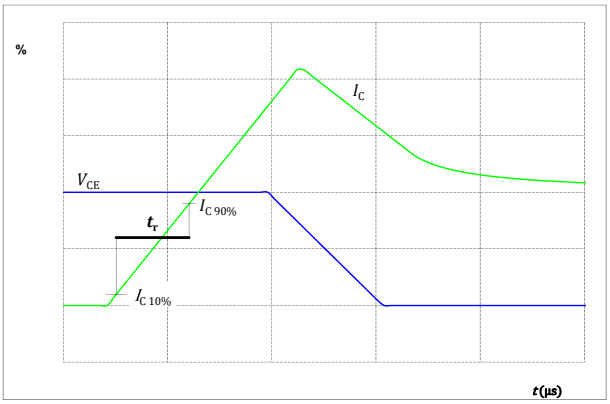


figure 55. MOSFET

Turn-on Switching Waveforms & definition of t_r



Boost Switching Definitions

figure 56. **FWD**

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

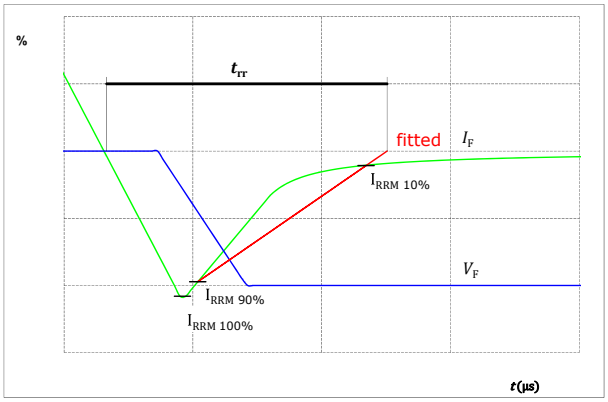


figure 57. **FWD**

Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})

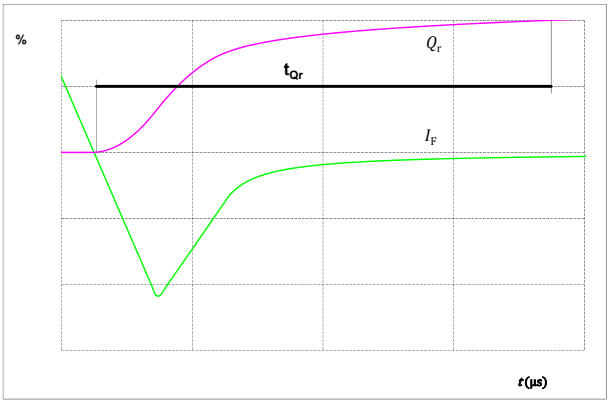
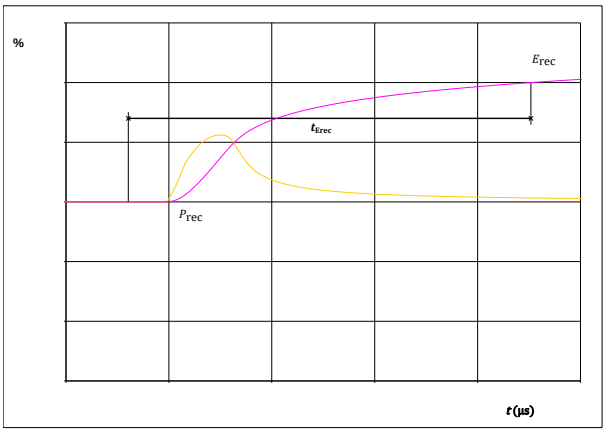


figure 58. **FWD**

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



Ordering Code

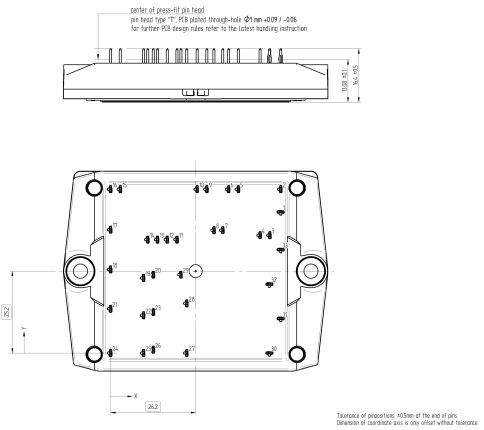
Version	Ordering Code
Without thermal paste	B0-SP12VPA025M702-LR28A13T
With thermal paste (5,2 W/mK, PTM6000HV)	B0-SP12VPA025M702-LR28A13T-/7/
With thermal paste (5,2 W/mK, PTM6000HV) and Protection Foil	B0-SP12VPA025M702-LR28A13T-/7F/

Marking

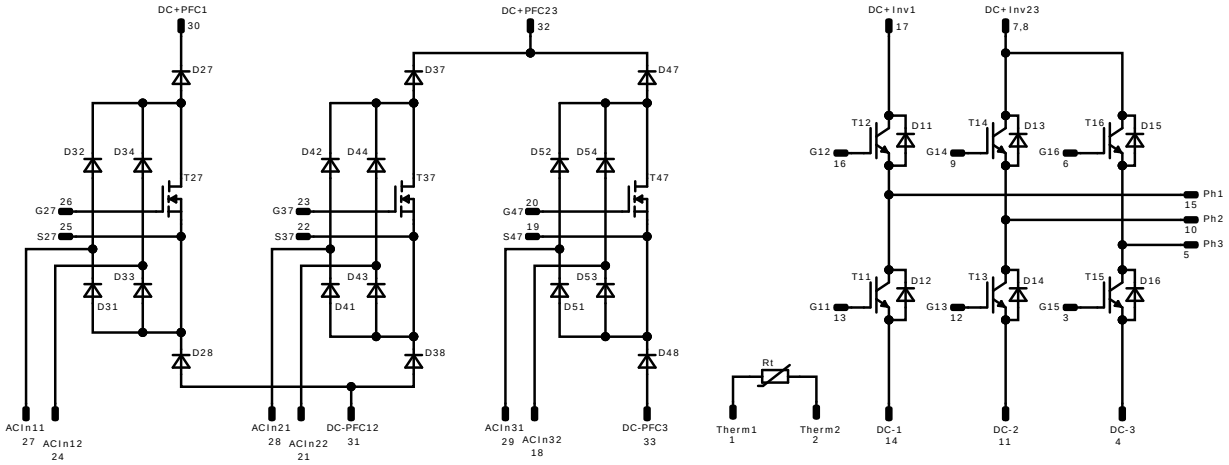
	Name		Date code	UL & VIN	Lot	Serial
Text	NN-NNNNNNNNNNNNN-TTTTTTVV		WWYY	UL VIN	LLLLL	SSSS
Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

Outline

Pin table [mm]			
Pin	X	Y	Function
1	52,4	43,4	Therm1
2	52,4	50,4	Therm2
3	49,05	36,25	G15
4	46,05	36,25	DC-3
5	39,35	50,4	Ph3
6	36,35	50,4	G16
7	34,55	37,8	DC+Inv23
8	31,85	37,8	DC+Inv23
9	29,65	50,4	G14
10	26,65	50,4	Ph2
11	20,45	34,9	DC-2
12	17,45	34,9	G13
13	14,45	34,9	G11
14	11,45	34,9	DC-1
15	3	50,4	Ph1
16	0	50,4	G12
17	0	37,95	DC+Inv1
18	0	25,7	ACIn32
19	10,15	23,1	S47
20	13,15	24,1	G47
21	0	13,6	ACIn22
22	10,15	11,6	S37
23	13,15	12,6	G37
24	0	0	ACIn12
25	10,15	0	S27
26	13,15	1	G27
27	23,45	0	ACIn11
28	23,45	15,3	ACIn21
29	21,65	24,1	ACIn31
30	48,9	0	DC+PFC1
31	52,4	10,6	DC-PFC12
32	48,9	21,2	DC+PFC23
33	52,4	31,8	DC-PFC3



Pinout



Identification					
ID	**Component**	**Voltage**	**Current**	**Function**	**Comment**
T11, T12, T13, T14, T15, T16	IGBT	1200 V	25 A	Inverter Switch	
D11, D12, D13, D14, D15, D16	FWD	1200 V	25 A	Inverter Diode	
T27, T37, T47	MOSFET	600 V	49 mΩ	Boost Switch	
D27, D37, D47	FWD	650 V	30 A	Boost Diode	
D28, D38, D48	FWD	650 V	30 A	Negative Boost Diode	
D31, D32, D33, D34, D41, D42, D43, D44, D51, D52, D53, D54	Rectifier	1600 V	30 A	Rectifier Diode	
Rt	Thermistor			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 45	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* S3 packages see vincotech.com website.

Package data
Package data for *flow* S3 packages see vincotech.com website.

Vincotech thermistor reference
See Vincotech thermistor reference table at vincotech.com website.

UL recognition and file number
This device is UL 1557 recognized under E192116 up to a junction temperature under switching condition $T_{j,op}$=150°C and up to 4000VAC/1min isolation voltage. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
B0-SP12VPA025M702-LR28A13T-D4-14	15 May. 2026	Update Product Line	