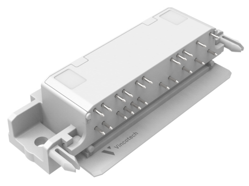
V23990-P639-A40-PM
datasheet

***flow*90PIM 1** **1200 V / 8 A**

Features

- Trench Fieldstop Technology IGBT4 for low saturation loss
- Supports design with 90° mounting angle between heatsink and PCB
- Clip-in PCB mounting
- Clip or screw on heatsink mounting

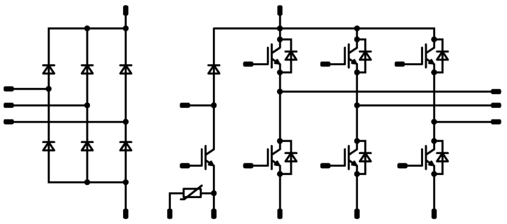
*flow*90 1 housing



Target applications

- Industrial drives

Schematic



Types

- V23990-P639-A40-PM

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		A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		24	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	61	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	10	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	19	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		20	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	46	W
Maximum junction temperature	T_{jmax}			175	°C
Brake Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	9	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		12	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	39	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	10	µs
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Brake Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	10	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		6	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	25	W
Maximum junction temperature	T_{jmax}			150	°C
Rectifier Diode					
Peak repetitive reverse voltage	V_{RRM}			1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	33	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	200	A
Surge current capability	I^2t			200	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	44	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	6000	V
Isolation voltage	V_{isol}	AC Voltage	t_p = 1 min	2500	V
Creepage distance				>12,7	mm
Clearance				11,67	mm
Comparative Tracking Index	CTI			≥ 200	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions	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	Unit
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00015	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		8	25 150	1,58	 1,07	2,07(1)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			1	µA
Gate-emitter leakage current	I_{GES}		20	0		25			120	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		490		pF
Reverse transfer capacitance	C_{res}							30		pF
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,57		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 32 Ω R_{goff} = 32 Ω	±15	600	8	25 150		57,6 58,8		ns
Rise time	t_r					25 150		22,6 22,4		ns
Turn-off delay time	$t_{d(off)}$					25 150		176,8 243,6		ns
Fall time	t_f					25 150		64,27 136,9		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,808 µC Q_{rFWD}=1,66 µC				25 150		0,51 0,826		mWs
Turn-off energy (per pulse)	E_{off}					25 150		0,455 0,784		mWs

Characteristic Values

Parameter	Symbol	Conditions	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	Unit
Inverter Diode										
Static										
Forward voltage	V_F				10	25	1,35	1,86	2,05[(1)]	V
Reverse leakage current	I_R	V_r = 1200 V				25			2,7	µA
Thermal										
Thermal resistance junction to sink [(2)]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,07		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=338 A/µs d*i*/d*t*=335 A/µs	±15	600	8	25 150		7,24 9,25		A
Reverse recovery time	t_{rr}					25 150		241,38 416,06		ns
Recovered charge	Q_r					25 150		0,808 1,66		µC
Reverse recovered energy	E_{rec}					25 150		0,315 0,661		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		88,58 51,21		A/µs

Characteristic Values

Parameter	Symbol	Conditions	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	Unit
Brake Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00015	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		4	25 150	1,58	2,2	2,02(1)	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			0,5	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		250		pF
Reverse transfer capacitance	C_{res}	f = 1 Mhz	0	25		25		15		pF
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,43		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 64 Ω R_{goff} = 64 Ω	±15	600	4	25 150		83,2 79		ns
Rise time	t_r	R_{gon} = 64 Ω R_{goff} = 64 Ω	±15	600	4	25 150		27,6 31,8		ns
Turn-off delay time	$t_{d(off)}$	R_{gon} = 64 Ω R_{goff} = 64 Ω	±15	600	4	25 150		178,2 242,8		ns
Fall time	t_f	R_{gon} = 64 Ω R_{goff} = 64 Ω	±15	600	4	25 150		76,83 131,54		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,442 µC Q_{rFWD}=0,949 µC	±15	600	4	25 150		0,255 0,387		mWs
Turn-off energy (per pulse)	E_{off}		±15	600	4	25 150		0,239 0,407		mWs

Characteristic Values

Parameter	Symbol	Conditions	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]	Values Min	Typ	Max	Unit
Brake Diode										
Static										
Forward voltage	V_F				3	25 150	1,23	1,65 1,52	1,97(1)	V
Reverse leakage current	I_R	V_r = 1200 V				25			27	μA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,8		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=139 A/μs d*i*/d*t*=125 A/μs	±15	600	4	25 150		2,77 3,62		A
Reverse recovery time	t_{rr}					25 150		356,63 648,71		ns
Recovered charge	Q_r					25 150		0,442 0,949		μC
Reverse recovered energy	E_{rec}					25 150		0,196 0,44		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 150		18,12 14,27		A/μs
Rectifier Diode										
Static										
Forward voltage	V_F				8	25 125		0,996 0,907	1,21(1) 1,1(1)	V
Reverse leakage current	I_R	V_r = 1600 V				25			50	μA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,59		K/W

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	
Thermistor										
Static										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1486 Ω				100	-12		14	%
Power dissipation	P							200		mW
Power dissipation constant	d					25		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3 %						3950		K
B-value	$B_{(25/100)}$	Tol. ±3 %						3998		K
Vincotech Thermistor Reference									B	

(1) Value at chip level

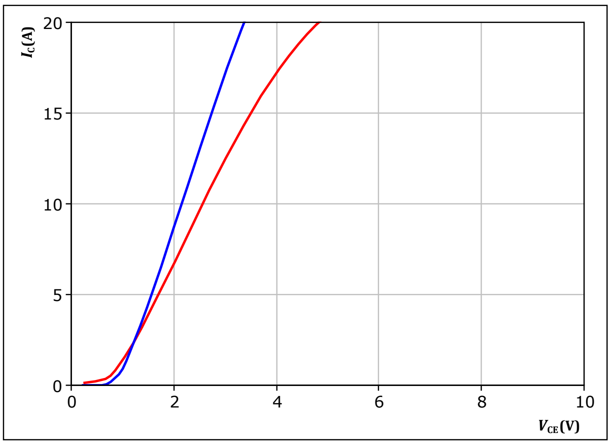
(2) Only valid with pre-applied Vincotech thermal interface material.

Inverter Switch Characteristics

figure 1. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

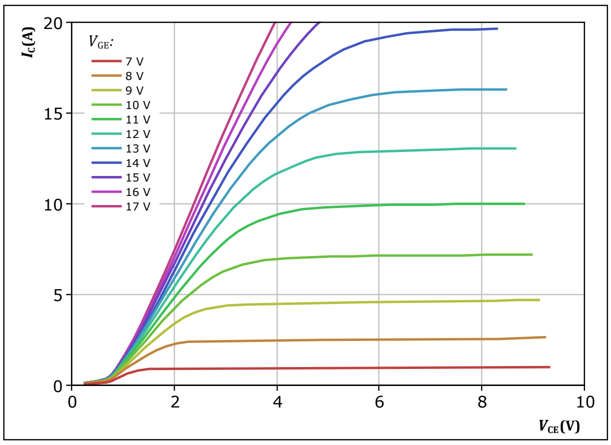


t_p = 250 µs
V_{GE} = 15 V
T_j: 25 °C, 150 °C

figure 2. IGBT

Typical output characteristics

$I_C = f(V_{CE})$

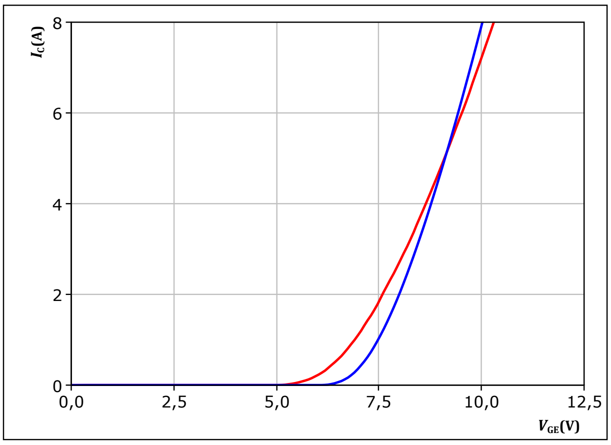


t_p = 250 µs
T_j = 150 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

$I_C = f(V_{GE})$

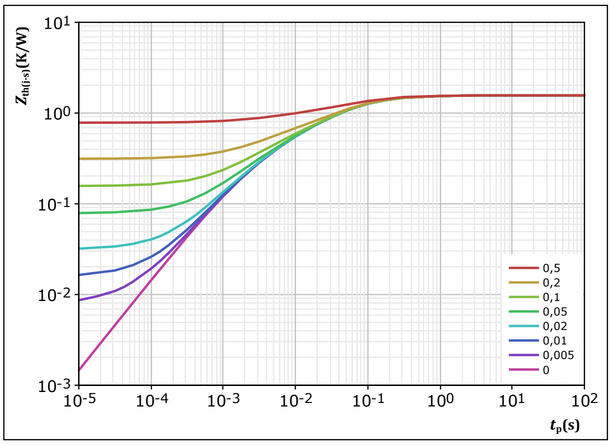


t_p = 250 µs
V_{CE} = 10 V
T_j: 25 °C, 150 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



D = t_p / T
$R_{th(j-s)}$ = 1,566 K/W

IGBT thermal model values

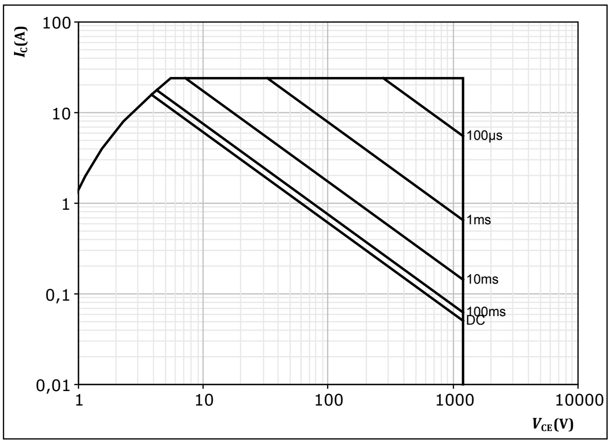
R (K/W)	τ (s)
1,42E-01	5,98E-01
6,32E-01	7,71E-02
3,98E-01	2,43E-02
2,86E-01	6,16E-03
1,08E-01	1,44E-03

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

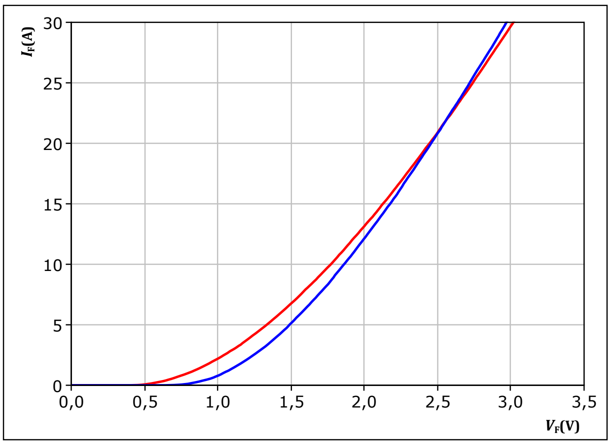
T_j = T_{jmax}

Inverter Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

I_F = f(V_F)



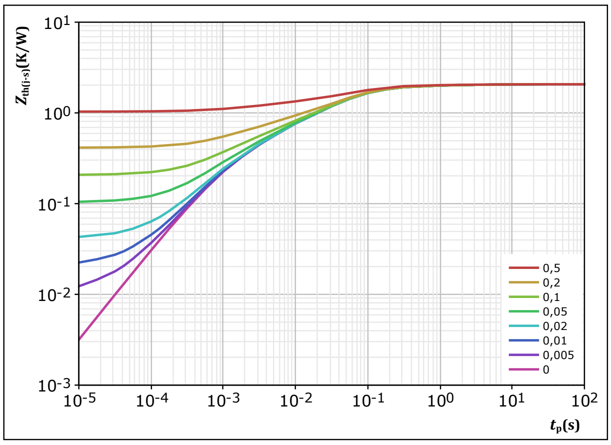
t_p = 250 µs

T_j: 25 °C, 150 °C

figure 7. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 2,066 K/W

FWD thermal model values

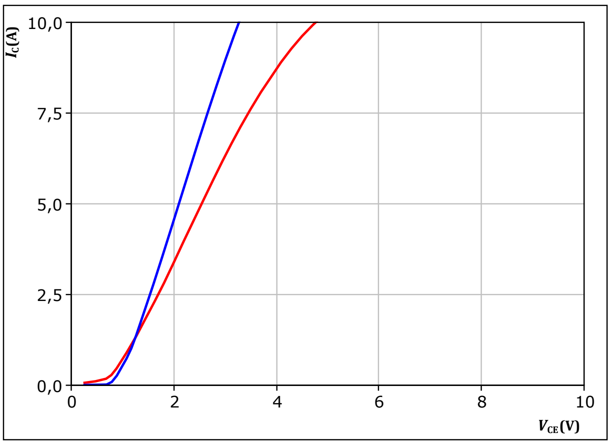
R (K/W)	τ (s)
5,09E-02	4,26E+00
1,55E-01	5,03E-01
7,75E-01	7,89E-02
5,33E-01	2,68E-02
3,54E-01	5,03E-03
1,97E-01	9,09E-04

Brake Switch Characteristics

figure 8. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

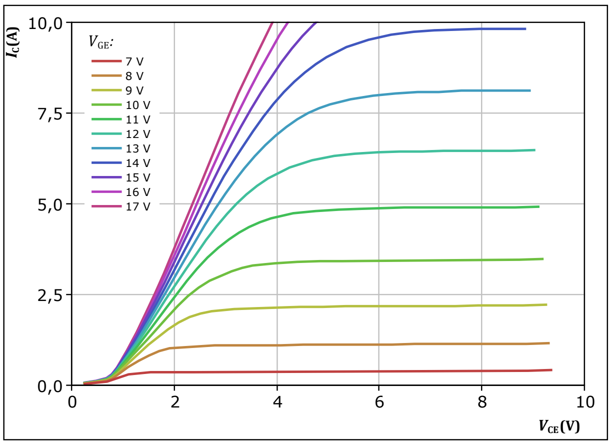


t_p =	250	µs	T_j:	25 °C
V_{GE} =	15	V		150 °C

figure 9. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



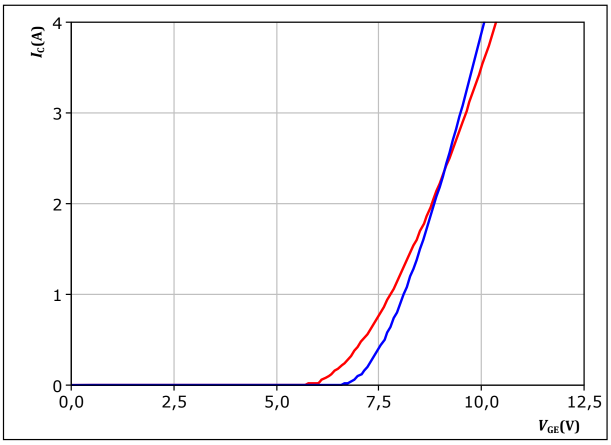
t_p =	250	µs
T_j =	150	°C

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

figure 10. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})

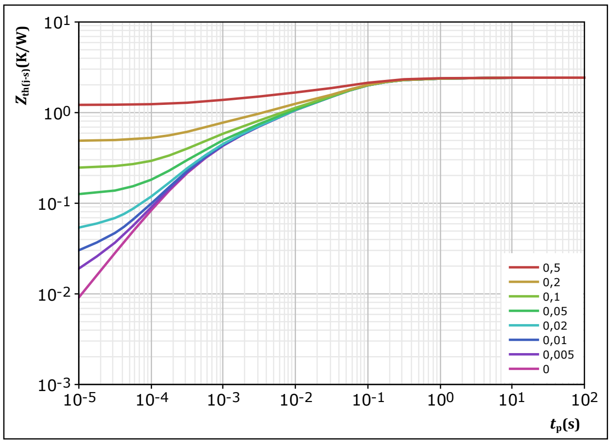


t_p =	250	µs	T_j:	25 °C
V_{CE} =	10	V		150 °C

figure 11. **IGBT**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	2,432	K/W

IGBT thermal model values

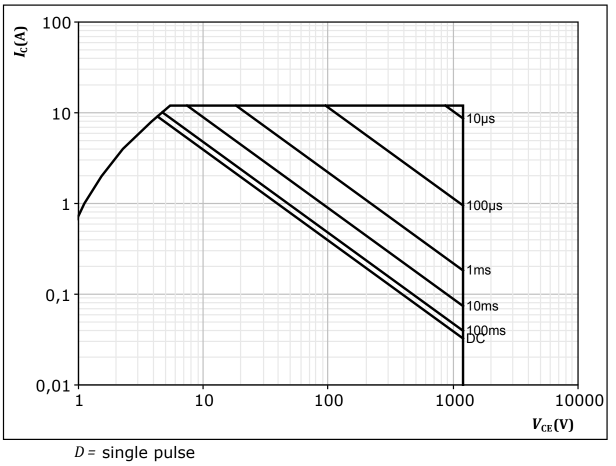
R (K/W)	τ (s)
7,91E-02	3,00E+00
3,56E-01	1,96E-01
1,03E+00	5,06E-02
5,26E-01	6,13E-03
2,36E-01	1,15E-03
2,06E-01	3,36E-04

Brake Switch Characteristics

figure 12. **IGBT**

Safe operating area

I_C = f(V_{CE})



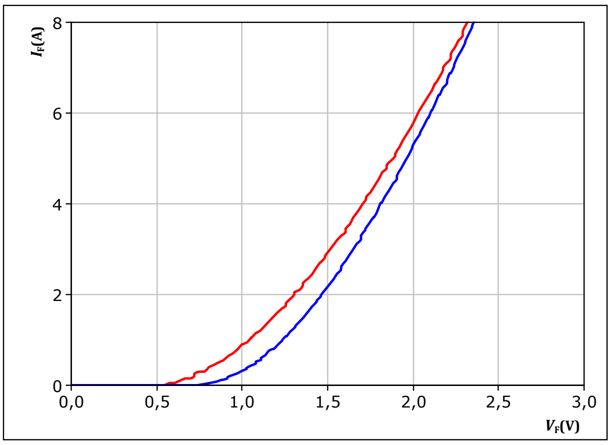
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Brake Diode Characteristics

figure 13. FWD

Typical forward characteristics

I_F = f(V_F)



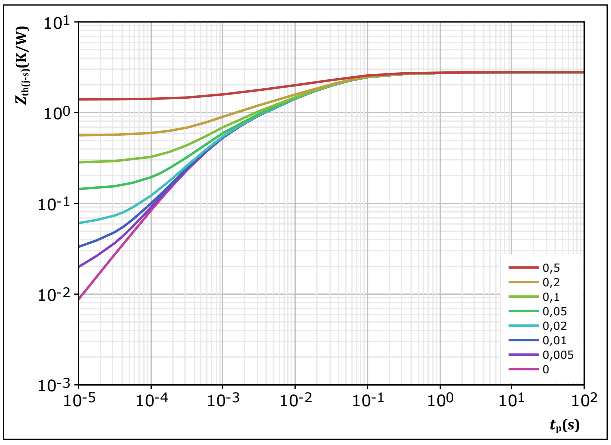
t_p = 250 µs

T_j: 25 °C, 150 °C

figure 14. FWD

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 2,796 K/W

FWD thermal model values

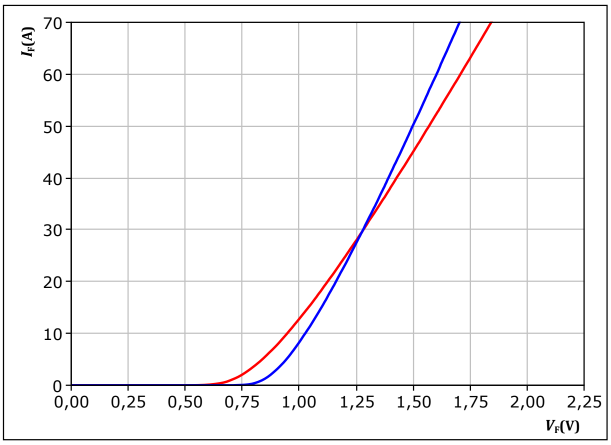
R (K/W)	τ (s)
7,82E-02	2,45E+00
1,95E-01	2,65E-01
9,84E-01	4,77E-02
6,58E-01	1,23E-02
5,09E-01	2,70E-03
3,71E-01	5,98E-04

Rectifier Diode Characteristics

figure 15. **Rectifier**

Typical forward characteristics

$I_F = f(V_F)$



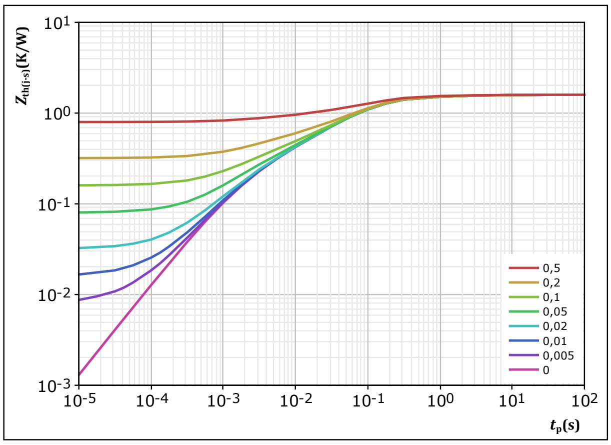
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 16. **Rectifier**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,594 K/W

Rectifier thermal model values

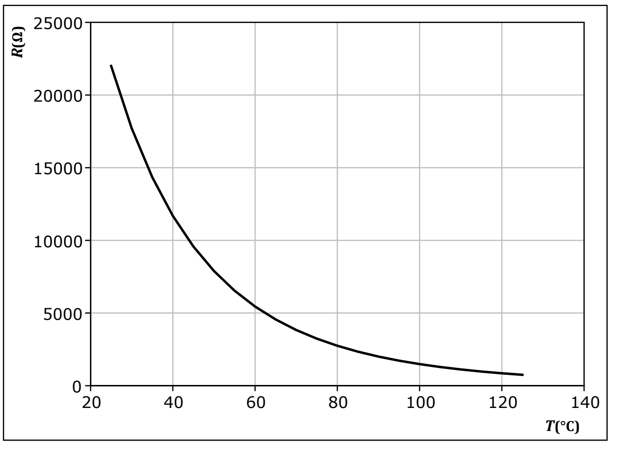
R (K/W)	τ (s)
3,44E-02	9,66E+00
1,12E-01	1,22E+00
5,81E-01	1,45E-01
4,89E-01	5,05E-02
2,38E-01	9,26E-03
1,22E-01	1,79E-03
1,81E-02	7,88E-04

Thermistor Characteristics

figure 17. **Thermistor**

Typical NTC characteristic as function of temperature

R_T = f(T)

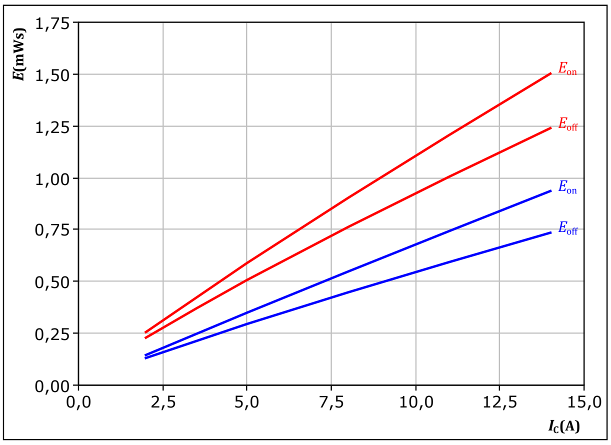


Inverter Switching Characteristics

figure 18. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



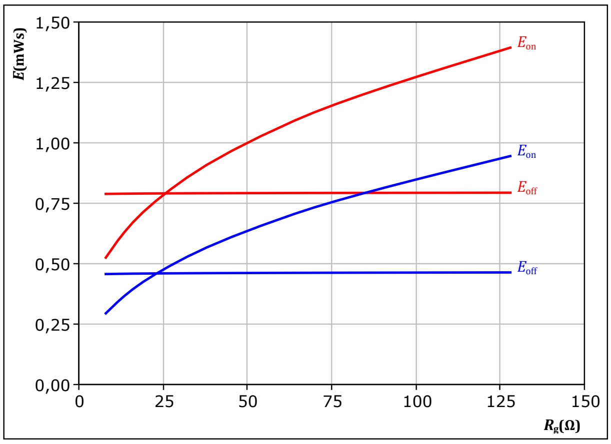
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		150 °C
R_{gon} =	32	Ω		
R_{goff} =	32	Ω		

figure 19. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



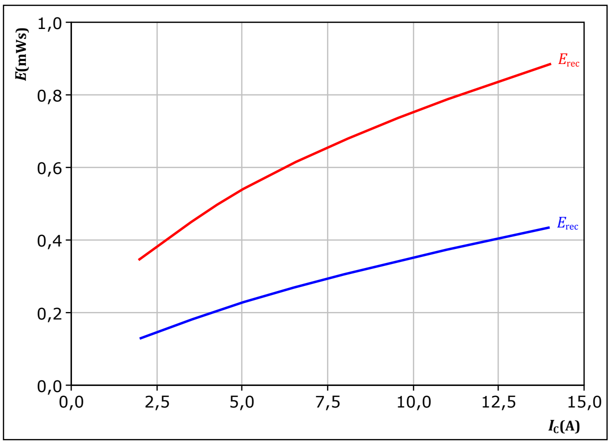
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		150 °C
I_C =	8	A		

figure 20. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



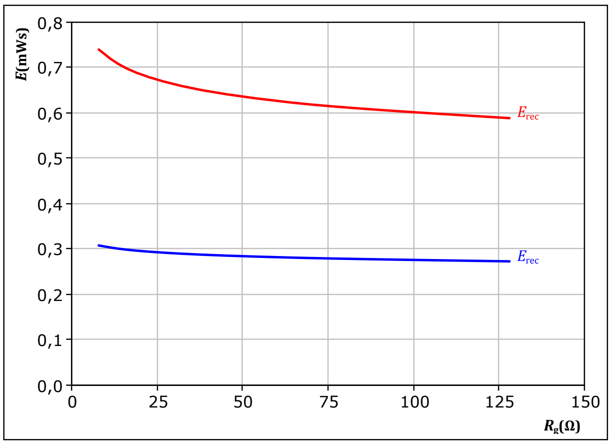
With an inductive load at

V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		150 °C
R_{gon} =	32	Ω		

figure 21. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

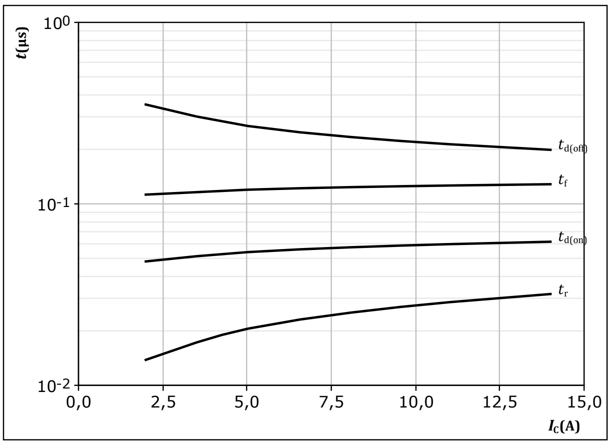
V_{CE} =	600	V	T_j:	25 °C
V_{GE} =	±15	V		150 °C
I_C =	8	A		

Inverter Switching Characteristics

figure 22. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



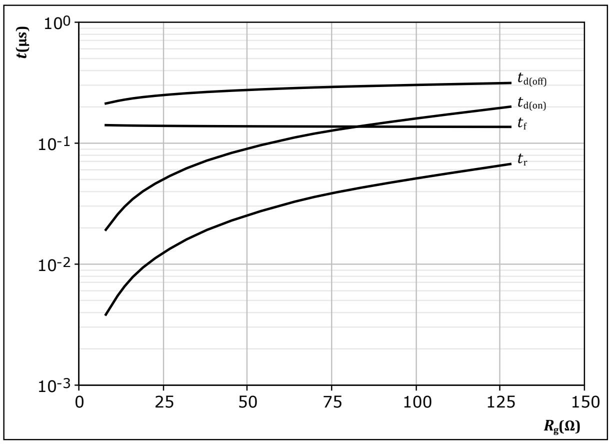
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω
R_{goff} =	32	Ω

figure 23. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



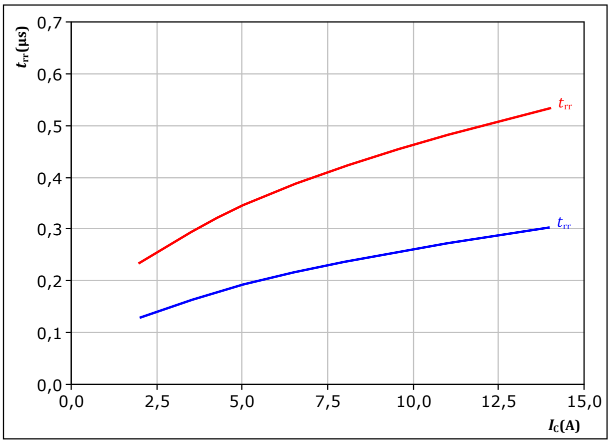
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	8	A

figure 24. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



With an inductive load at

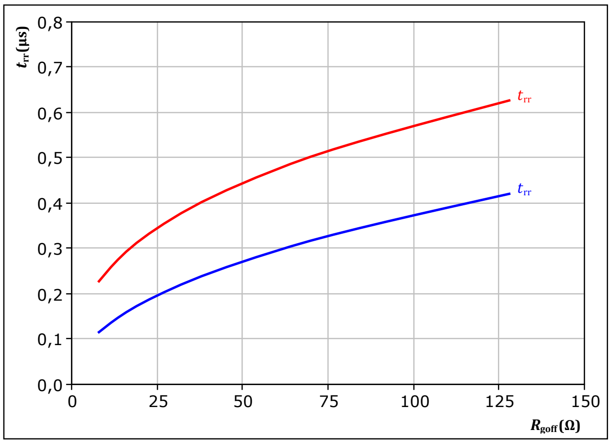
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	32	Ω

T_j: 25 °C, 150 °C

figure 25. **FWD**

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

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



With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	8	A

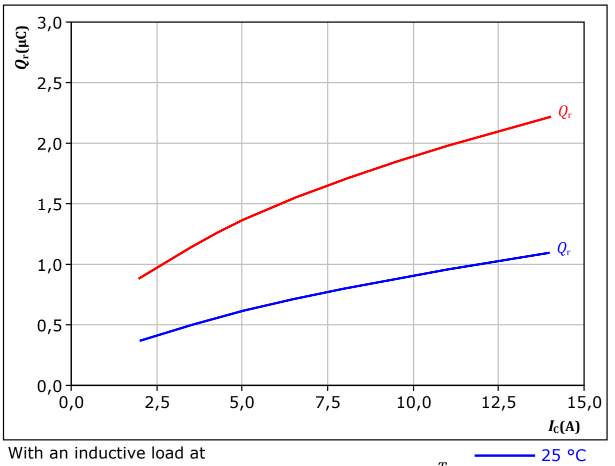
T_j: 25 °C, 150 °C

Inverter Switching Characteristics

figure 26. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$



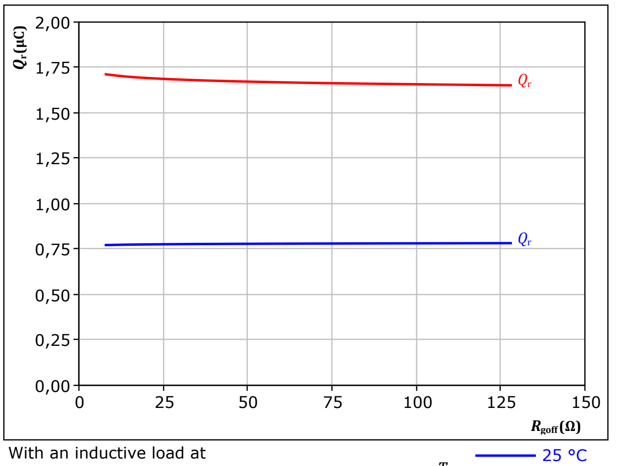
With an inductive load at

V_{CE} =	600	V	T_j: — 25 °C
V_{GE} =	±15	V	— 150 °C
R_{gon} =	32	Ω	

figure 27. **FWD**

Typical recovered charge as a function of turn off gate resistor

$Q_r = f(R_{goff})$



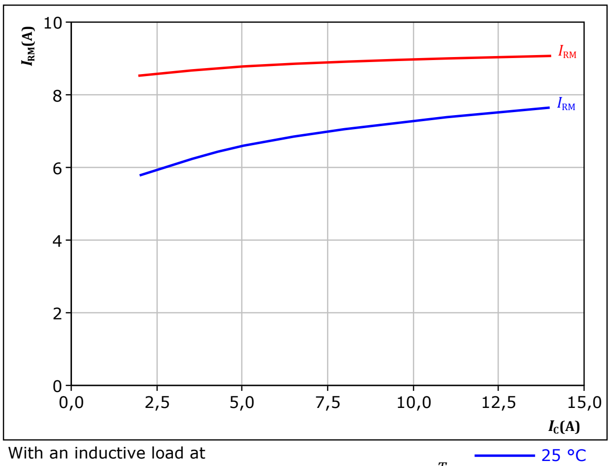
With an inductive load at

V_{CE} =	600	V	T_j: — 25 °C
V_{GE} =	±15	V	— 150 °C
I_C =	8	A	

figure 28. **FWD**

Typical peak reverse recovery current as a function of collector current

$I_{RM} = f(I_C)$



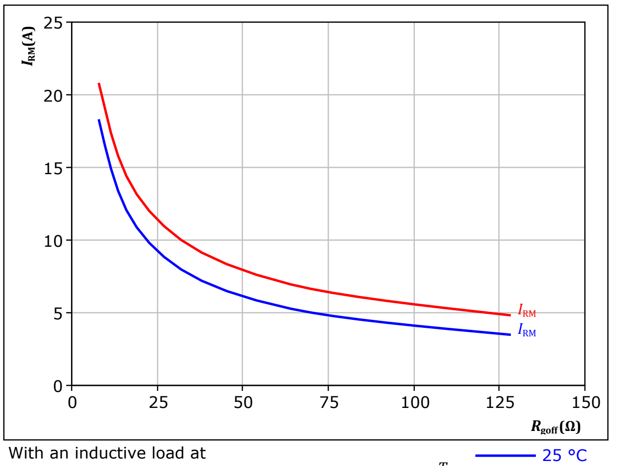
With an inductive load at

V_{CE} =	600	V	T_j: — 25 °C
V_{GE} =	±15	V	— 150 °C
R_{gon} =	32	Ω	

figure 29. **FWD**

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

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



With an inductive load at

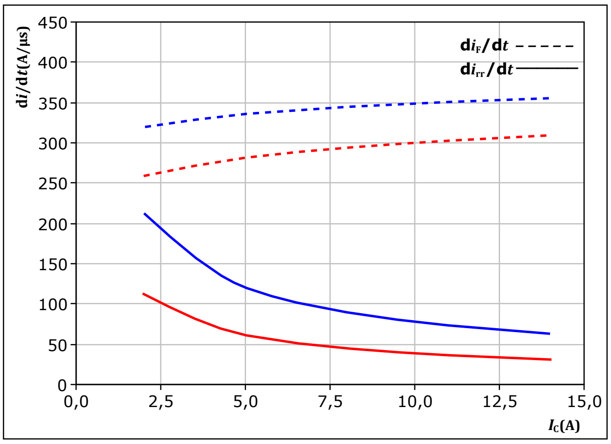
V_{CE} =	600	V	T_j: — 25 °C
V_{GE} =	±15	V	— 150 °C
I_C =	8	A	

Inverter Switching Characteristics

figure 30. 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)



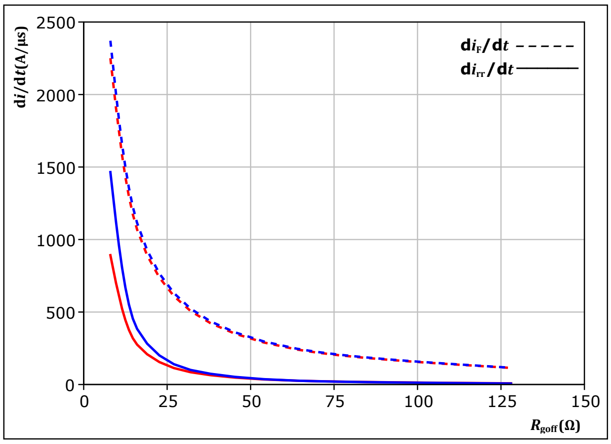
With an inductive load at

V_{CE} =	600	V	T_j: 25 °C / 150 °C
V_{GE} =	±15	V	
R_{gon} =	32	Ω	

figure 31. FWD

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

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



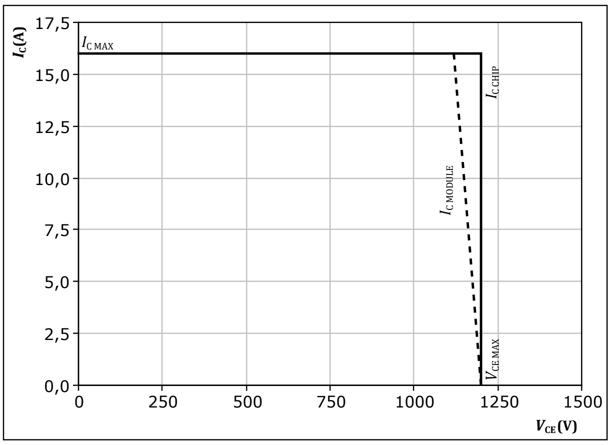
With an inductive load at

V_{CE} =	600	V	T_j: 25 °C / 150 °C
V_{GE} =	±15	V	
I_C =	8	A	

figure 32. IGBT

Reverse bias safe operating area

I_C = f(V_{CE})



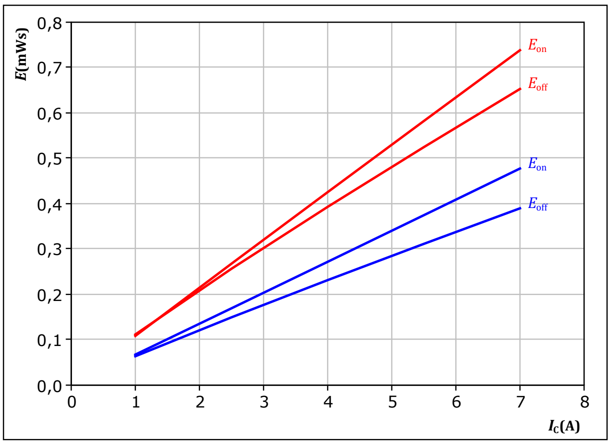
At	T_j =	150	°C
	R_{gon} =	32	Ω
	R_{goff} =	32	Ω

Brake Switching Characteristics

figure 33. **IGBT**

Typical switching energy losses as a function of collector current

E = f(I_C)



With an inductive load at

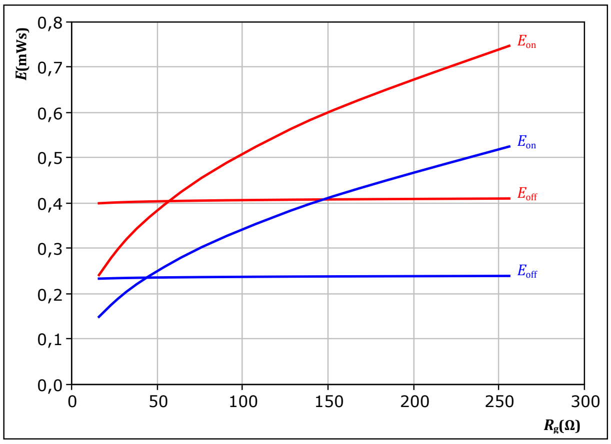
V_{CE} =	600	V	
V_{GE} =	±15	V	
R_{gon} =	64	Ω	
R_{goff} =	64	Ω	

T_j: 25 °C (blue), 150 °C (red)

figure 34. **IGBT**

Typical switching energy losses as a function of gate resistor

E = f(R_g)



With an inductive load at

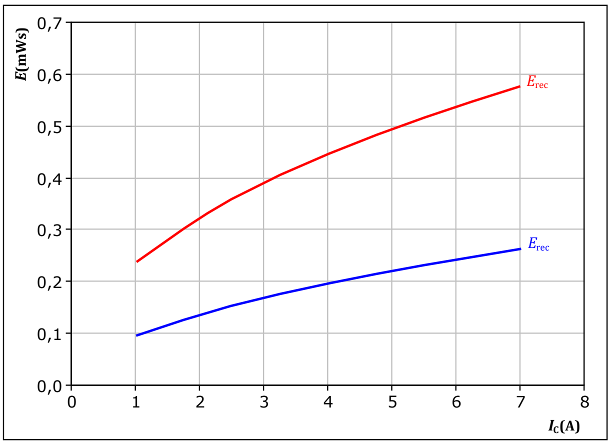
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	4	A

T_j: 25 °C (blue), 150 °C (red)

figure 35. **FWD**

Typical reverse recovered energy loss as a function of collector current

E_{rec} = f(I_C)



With an inductive load at

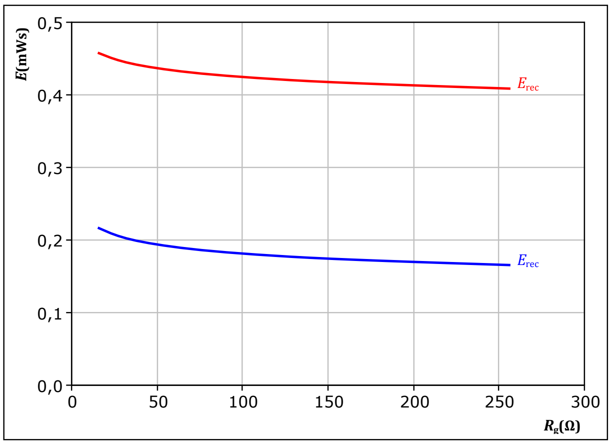
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	64	Ω

T_j: 25 °C (blue), 150 °C (red)

figure 36. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

E_{rec} = f(R_g)



With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	4	A

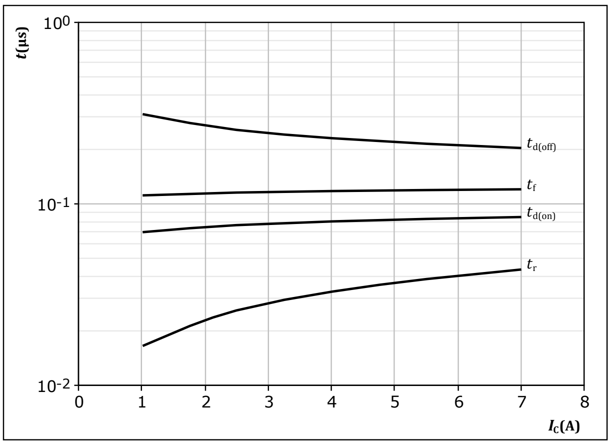
T_j: 25 °C (blue), 150 °C (red)

Brake Switching Characteristics

figure 37. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



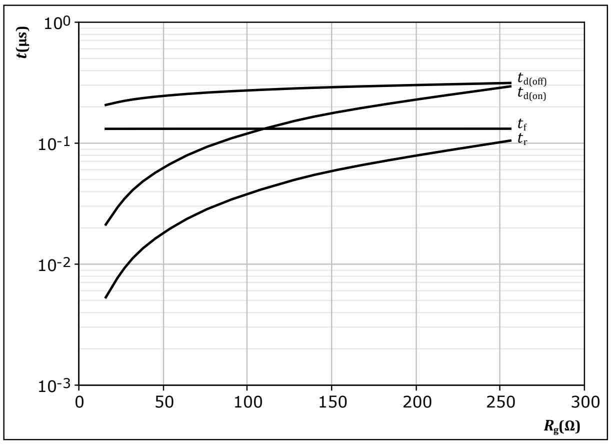
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	64	Ω
R_{goff} =	64	Ω

figure 38. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



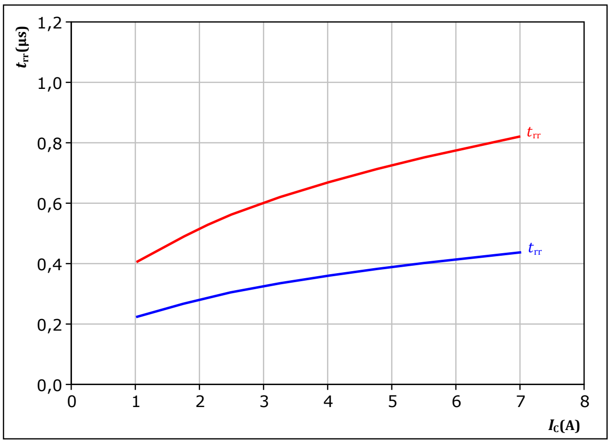
With an inductive load at

T_j =	150	°C
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	4	A

figure 39. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



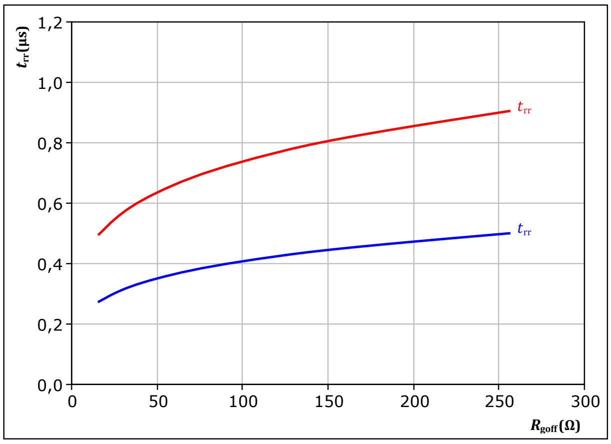
With an inductive load at

V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	64	Ω

figure 40. **FWD**

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

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



With an inductive load at

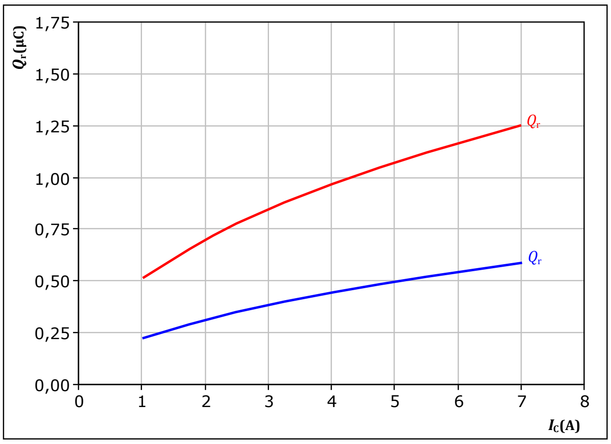
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	4	A

Brake Switching Characteristics

figure 41. **FWD**

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$



With an inductive load at

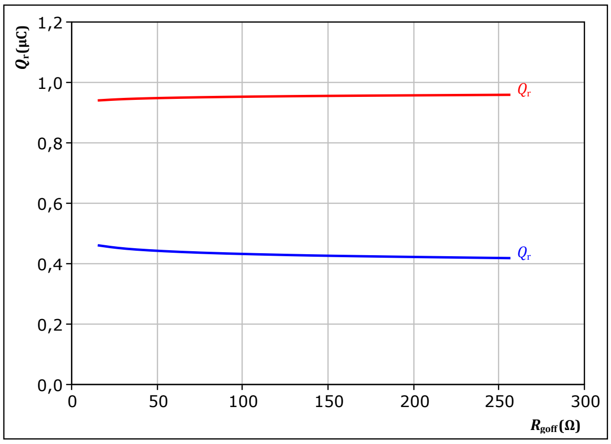
T_j: 25 °C, 150 °C

V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	64	Ω

figure 42. **FWD**

Typical recovered charge as a function of turn off gate resistor

$Q_r = f(R_{goff})$



With an inductive load at

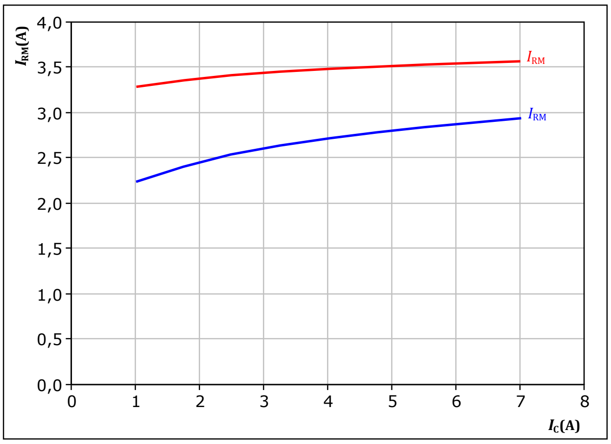
T_j: 25 °C, 150 °C

V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	4	A

figure 43. **FWD**

Typical peak reverse recovery current as a function of collector current

$I_{RM} = f(I_C)$



With an inductive load at

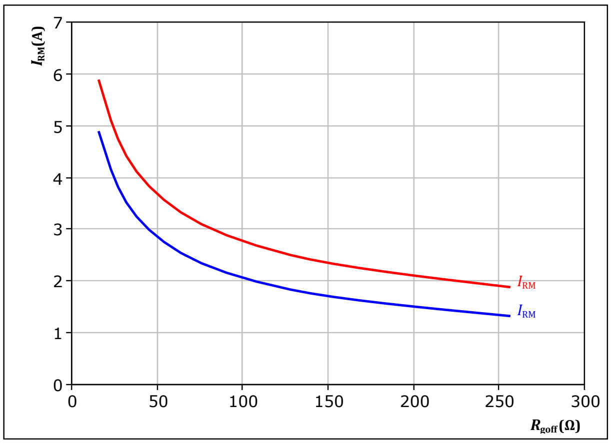
T_j: 25 °C, 150 °C

V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	64	Ω

figure 44. **FWD**

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

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



With an inductive load at

T_j: 25 °C, 150 °C

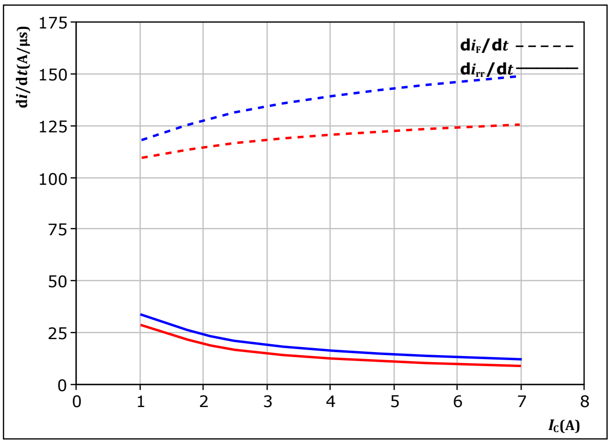
V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	4	A

Brake Switching Characteristics

figure 45. **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

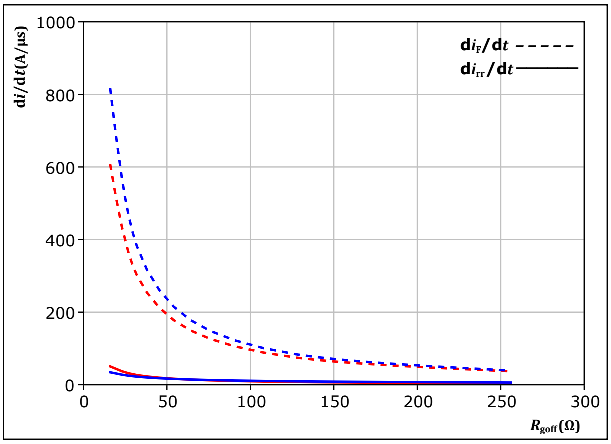
T_j: 25 °C, 150 °C

V_{CE} =	600	V
V_{GE} =	±15	V
R_{gon} =	64	Ω

figure 46. **FWD**

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

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



With an inductive load at

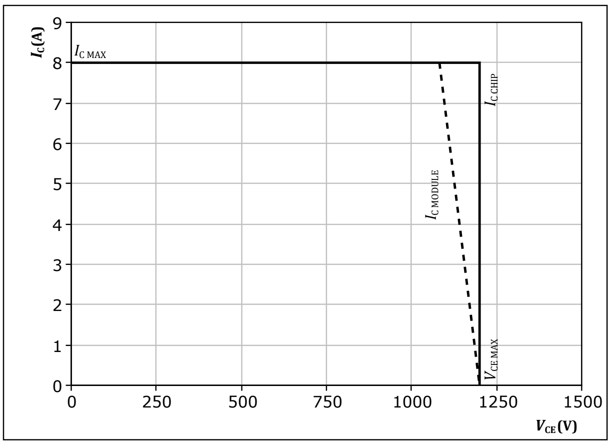
T_j: 25 °C, 150 °C

V_{CE} =	600	V
V_{GE} =	±15	V
I_C =	4	A

figure 47. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At			
	T_j =	150	°C
	R_{gon} =	64	Ω
	R_{goff} =	64	Ω

Switching Definitions

figure 48. **IGBT**

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

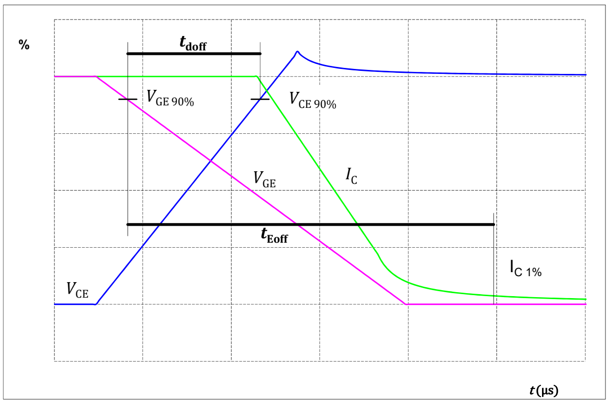


figure 49. **IGBT**

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

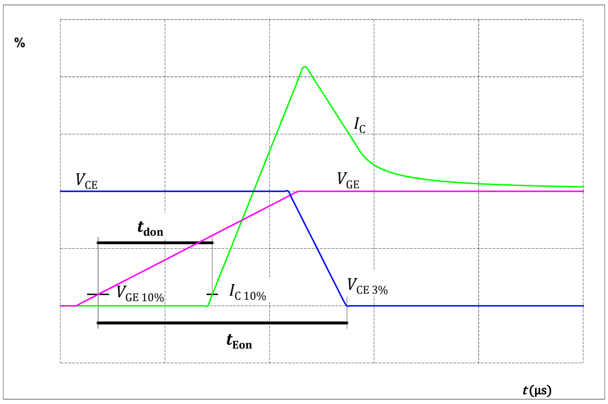


figure 50. **IGBT**

Turn-off Switching Waveforms & definition of t_f

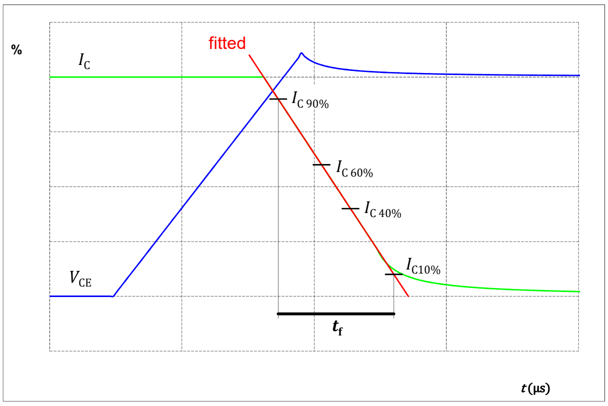
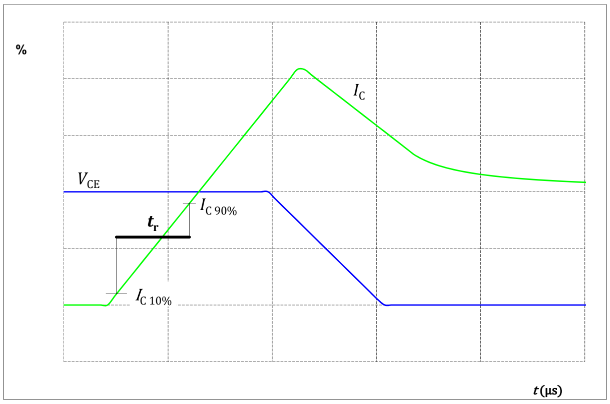


figure 51. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Switching Definitions

figure 52. **FWD**

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

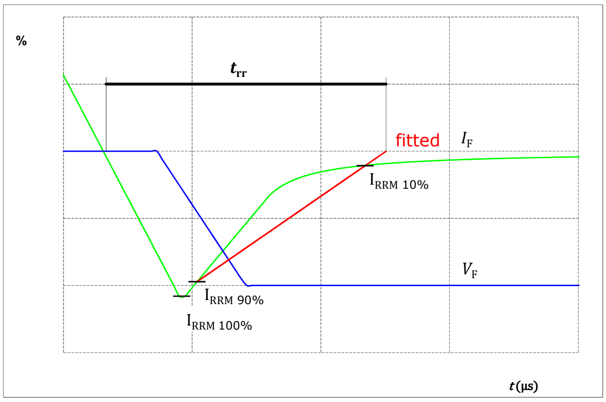
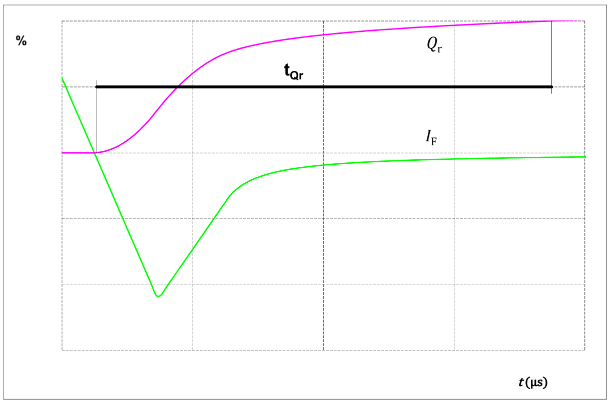


figure 53. **FWD**

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



Ordering Code

Version	Ordering Code
Without thermal paste	V23990-P639-A40-PM
With thermal paste (3,4 W/mK, PSX-P7)	V23990-P639-A40-/3/-PM

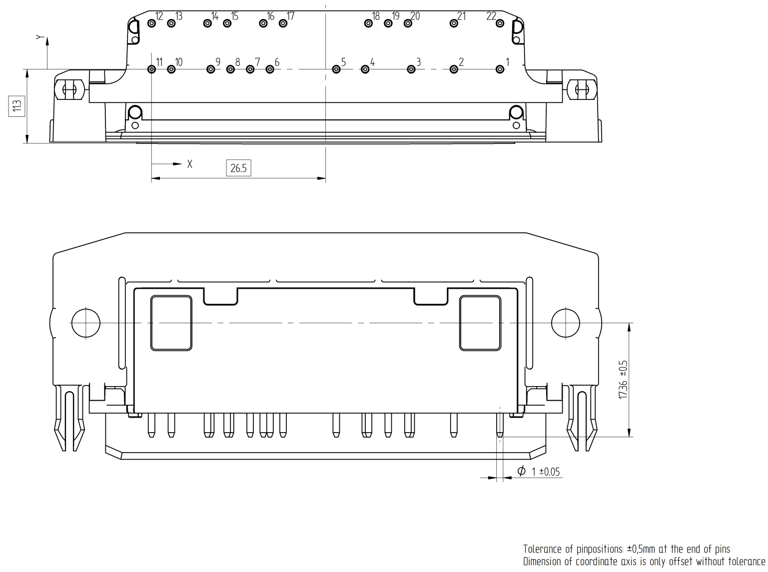
Marking

	**Text**	**VIN**	**Date code**	**Type&Ver**	**UL**	**Lot**	**Serial**
		VIN	WWYY	TTTTTTTVV	UL	LLLLL	SSSS
	Datamatrix	**Type&Ver**	**Lot number**	**Serial**	**Date code**		
		TTTTTTTVV	LLLLL	SSSS	WWYY		

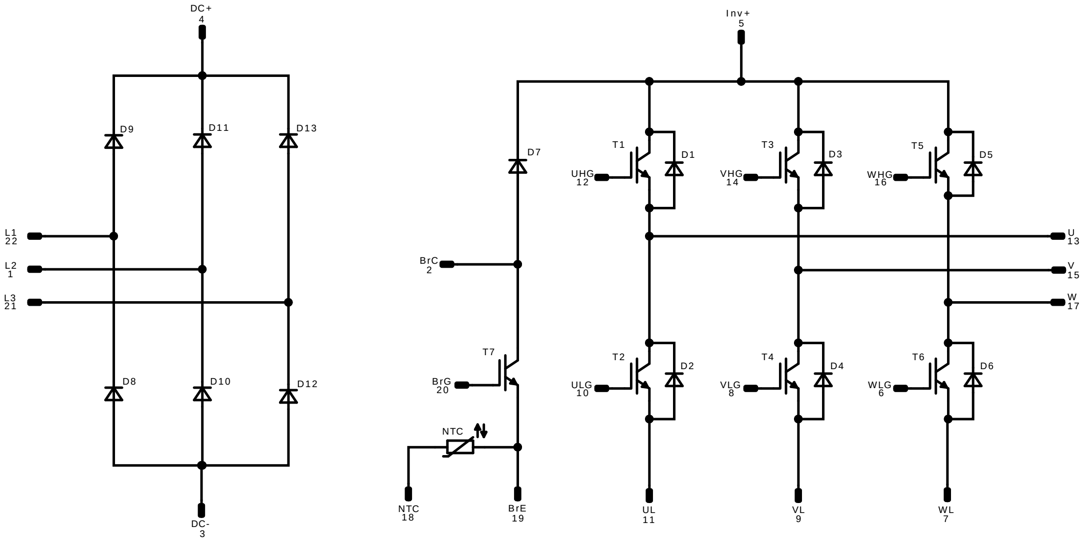
Outline

Pin table [mm]

Pin	X	Y	Function
1	53	0	L2
2	46	0	BrC
3	39,5	0	DC-
4	32,5	0	DC+
5	28,1	0	Inv+
6	18	0	WLG
7	15	0	WL
8	12	0	VLG
9	9	0	VL
10	3	0	ULG
11	0	0	UL
12	0	7	UHG
13	3	7	U
14	8,5	7	VHG
15	11,5	7	V
16	17	7	WHG
17	20	7	W
18	33	7	NTC
19	36	7	BrE
20	39	7	BrG
21	46	7	L3
22	53	7	L1



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T2, T1, T4, T3, T6, T5	IGBT	1200 V	8 A	Inverter Switch	
D1, D2, D3, D4, D5, D6	FWD	1200 V	10 A	Inverter Diode	
T7	IGBT	1200 V	4 A	Brake Switch	
D7	FWD	1200 V	3 A	Brake Diode	
D8, D9, D10, D11, D12, D13	Rectifier	1600 V	25 A	Rectifier Diode	
Rt	Thermistor			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 80	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow*90 1 packages see vincotech.com website.

Package data
Package data for *flow*90 1 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 certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.

Document No.:	**Date:**	**Modification:**	**Pages**
V23990-P639-A40-PM-D3-14	30 Sep. 2021	Change of Isolation voltage Change of Clearance distance Change of Rth values from P12 to PSX Change of Rectifier Diode Vf condition	