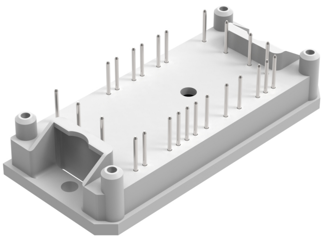
V23990-P484-A39-PM
datasheet

***flow*PIM 1** | **600 V / 15 A**

Features

- Power Integrated Module
- Trench Fieldstop IGBT's for low saturation losses
- Built-in NTC
- Compact and low inductive design

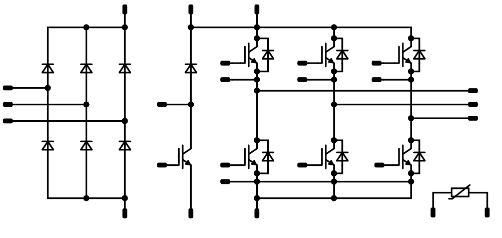
flow 1 17 mm housing



Target applications

- Embedded Drives
- Industrial Drives

Schematic



Types

- V23990-P484-A39-PM

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Inverter Switch					
Collector-emitter voltage	V_{CES}			600	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	22	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		45	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	52	W
Gate-emitter voltage	V_{GES}			±20	V
Short circuit ratings	t_{SC}	V_{GE} = 15 V, V_{CC} = 360 V	T_j = 150 °C	6	µs
Maximum junction temperature	T_{jmax}			175	°C
Inverter Diode					
Peak repetitive reverse voltage	V_{RRM}			600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	23	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		40	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	37	W
Maximum junction temperature	T_{jmax}			175	°C
Brake Switch					
Collector-emitter voltage	V_{CES}			600	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	13	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		18	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} = 360 V	T_j = 150 °C	6	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}			600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	21	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	38	W
Maximum junction temperature	T_{jmax}			175	°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	47	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	280	A
Surge current capability	I^2t			390	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	59	W
Maximum junction temperature	T_{jmax}			150	°C

Module Properties

Parameter	Symbol	Conditions		Value	Unit
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				>12,7	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 (Values)	Typ (Values)	Max (Values)	Unit
Inverter Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00021	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		15	25 150	1,1	1,6 1,85	1,9[1]	V
Collector-emitter cut-off current	I_{CES}		0	600		25			0,85	μA
Gate-emitter leakage current	I_{GES}		20	0		25			300	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		800		pF
Output capacitance	C_{oes}							55		pF
Reverse transfer capacitance	C_{res}							24		pF
Gate charge	Q_g		15		0	25		87		nC
Thermal										
Thermal resistance junction to sink [2]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,83		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 16 Ω R_{goff} = 16 Ω	±15	350	15	25 125 150		62,72 62,72 62,72		ns
Rise time	t_r					25 125 150		20,48 21,76 21,76		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		108,48 127,36 131,52		ns
Fall time	t_f					25 125 150		57,68 103,95 109,49		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,577 μC Q_{rFWD}=1,24 μC Q_{rFWD}=1,44 μC				25 125 150		0,252 0,374 0,406		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,363 0,488 0,516		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				20	25 125 150	1,25	1,7 1,58 1,58	1,95(1)	V
Reverse leakage current	I_R	V_r = 600 V				25			27	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,6		K/W
Dynamic										
Peak recovery current	I_{RRM}	d*i*/d*t*=859 A/µs d*i*/d*t*=804 A/µs d*i*/d*t*=789 A/µs	±15	350	15	25 125 150		10,02 13,29 14,25		A
Reverse recovery time	t_{rr}					25 125 150		164,73 234,74 258,64		ns
Recovered charge	Q_r					25 125 150		0,577 1,24 1,44		µC
Reverse recovered energy	E_{rec}					25 125 150		0,147 0,316 0,369		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		139,01 109,26 110,92		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	
Brake Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			9E-05	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		6	25 125	1,1	1,55 1,72	1,9(1)	V
Collector-emitter cut-off current	I_{CES}		0	600		25			0,4	µA
Gate-emitter leakage current	I_{GES}		20	0		25			300	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		368		pF
Output capacitance	C_{oes}							28		pF
Reverse transfer capacitance	C_{res}							11		pF
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,44		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 16 Ω R_{goff} = 16 Ω	0/15	400	5	25 125 150		17,92 14,4 15,04		ns
Rise time	t_r					25 125 150		11,52 14,4 14,08		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		129,28 152,64 157,76		ns
Fall time	t_f					25 125 150		84,62 99,99 103,5		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=0,268 µC Q_{rFWD}=0,581 µC Q_{rFWD}=0,685 µC				25 125 150		0,096 0,167 0,187		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,149 0,196 0,205		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	
Brake Diode										
Static										
Forward voltage	V_F				15	25 125 150	1,25	1,76 1,66 1,61	1,95(1)	V
Reverse leakage current	I_R	V_r = 600 V				25			27	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						2,51		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt=438 A/µs di/dt=419 A/µs di/dt=425 A/µs	0/15	400	5	25 125 150		4,76 7,44 8,02		A
Reverse recovery time	t_{rr}					25 125 150		120,32 157,5 174,65		ns
Recovered charge	Q_r					25 125 150		0,268 0,581 0,685		µC
Reverse recovered energy	E_{rec}					25 125 150		0,076 0,159 0,187		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		88,25 106,17 92,71		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				50	25 125		1,24 1,24	1,3(1) 1,33(1)	V
Reverse leakage current	I_R	V_r = 1600 V				25 150			20 1500	µA
Thermal										
Thermal resistance junction to sink (2)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,2		K/W
Thermistor										
Static										
Rated resistance	R					25		4,7		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 401 Ω				100	-5		5	%
Power dissipation	P							5		mW
Power dissipation constant	d					25		1,3		mW/K
B-value	$B_{(25/50)}$	Tol. ±3 %						3612		K
B-value	$B_{(25/100)}$	Tol. ±3 %						3650		K

(1) Value at chip level

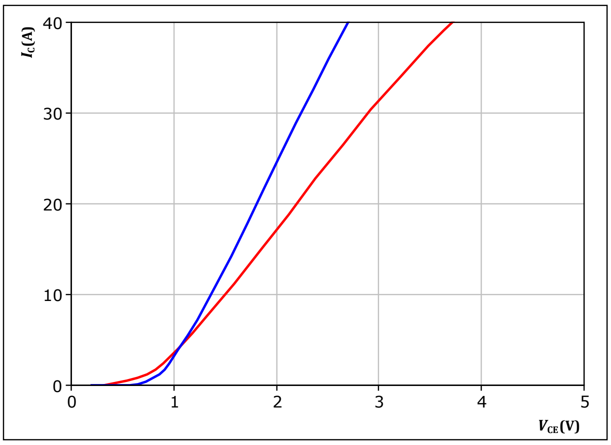
(2) Only valid with pre-applied Vincotech thermal interface material.

Inverter Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

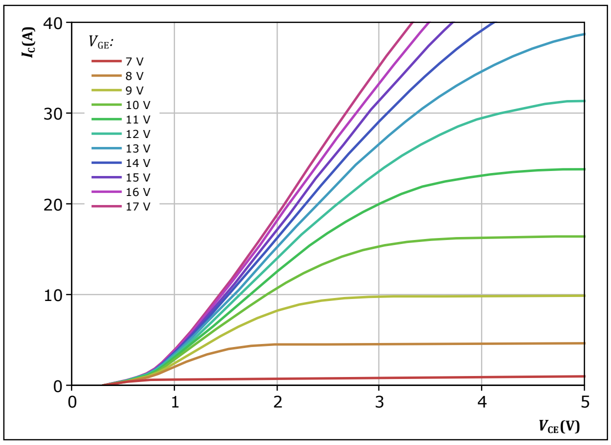


t_p = 250 µs
V_{GE} = 15 V
T_j: 25 °C, 150 °C

figure 2. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

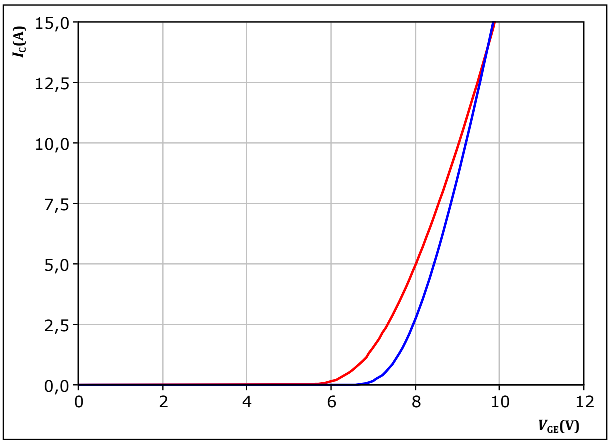


t_p = 250 µs
T_j = 150 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})

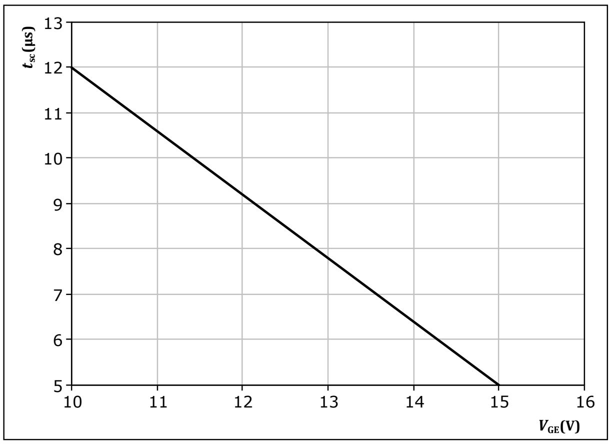


t_p = 250 µs
V_{CE} = 10 V
T_j: 25 °C, 150 °C

figure 4. **IGBT**

Short circuit withstand time as a function of V_{GE}

t_{sc} = f(V_{GE})



At V_{CE} = V
T_j ≤ °C

Inverter Switch Characteristics

figure 5. **IGBT**

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

Missing: ISC = f(VGE)

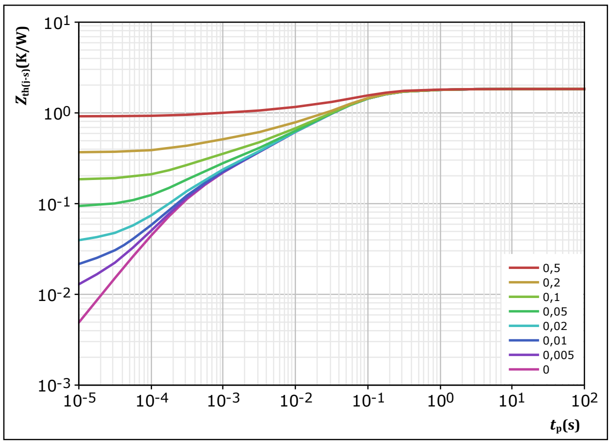
At

$T_j \leq$ °C

figure 6. **IGBT**

Transient thermal impedance as a function of pulse width

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



$D =$ t_p / T

$R_{th(j-s)} =$ 1,834 K/W

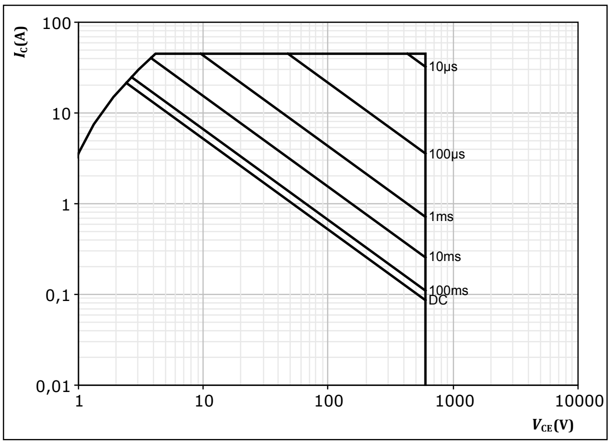
IGBT thermal model values

R (K/W)	τ (s)
8,30E-02	1,29E+00
3,76E-01	1,56E-01
8,46E-01	5,15E-02
2,81E-01	8,16E-03
1,16E-01	2,04E-03
1,32E-01	3,43E-04

figure 7. **IGBT**

Safe operating area

I_C = f(V_{CE})



$D =$ single pulse

$T_s =$ 80 °C

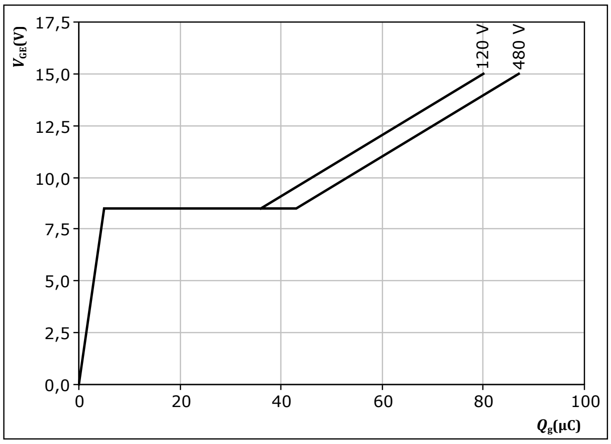
$V_{GE} =$ 15 V

$T_j =$ T_{jmax}

figure 8. **IGBT**

Gate voltage vs gate charge

V_{GE} = f(Q_g)



$I_C =$ 15 A

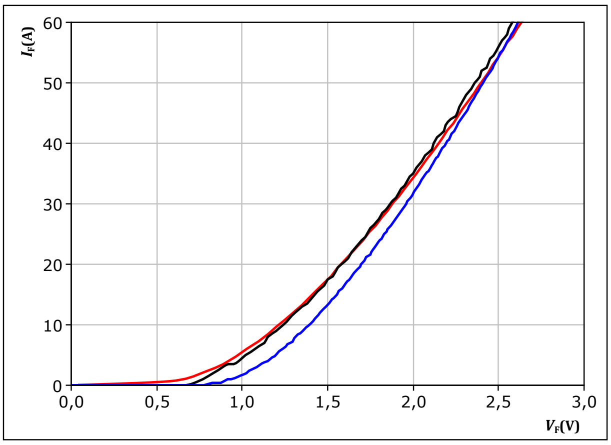
$T_j =$ 25 °C

Inverter Diode Characteristics

figure 9. **FWD**

Typical forward characteristics

I_F = f(V_F)



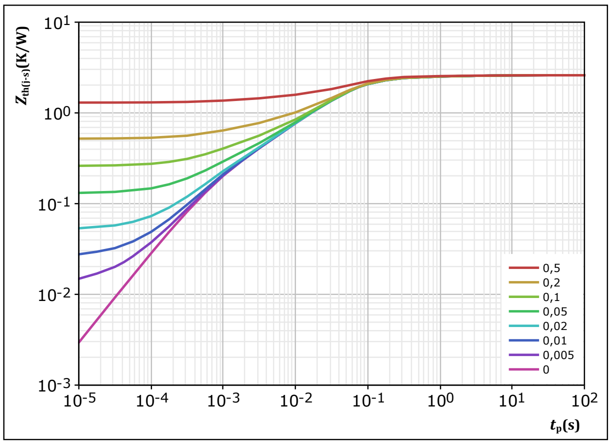
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 10. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 2,598 K/W

FWD thermal model values

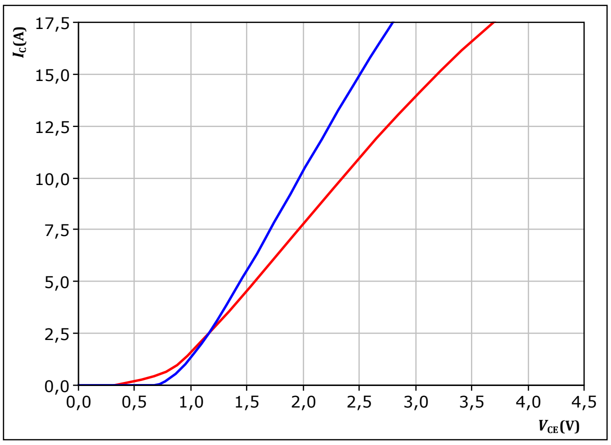
R (K/W)	τ (s)
6,56E-02	4,59E+00
1,58E-01	5,68E-01
8,97E-01	8,41E-02
1,05E+00	3,28E-02
2,75E-01	4,96E-03
1,51E-01	7,65E-04

Brake Switch Characteristics

figure 11. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



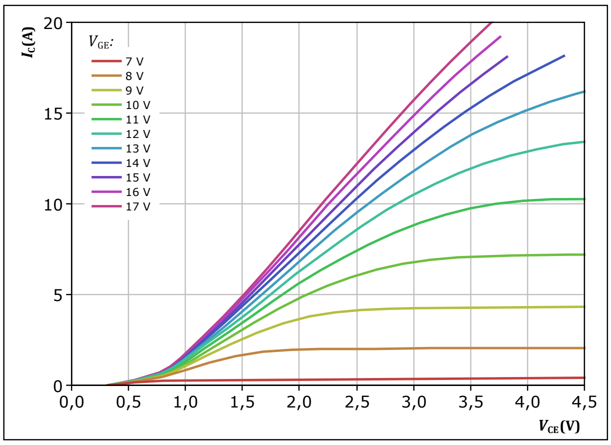
t_p =	250	μs
V_{GE} =	15	V

T_j: 25 °C, 125 °C

figure 12. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



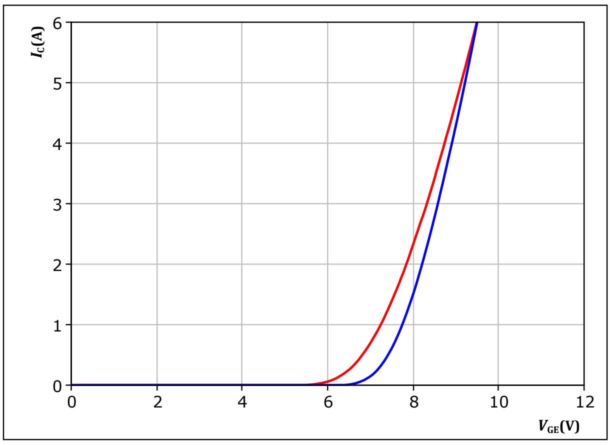
t_p =	250	μs
T_j =	125	°C

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

figure 13. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})



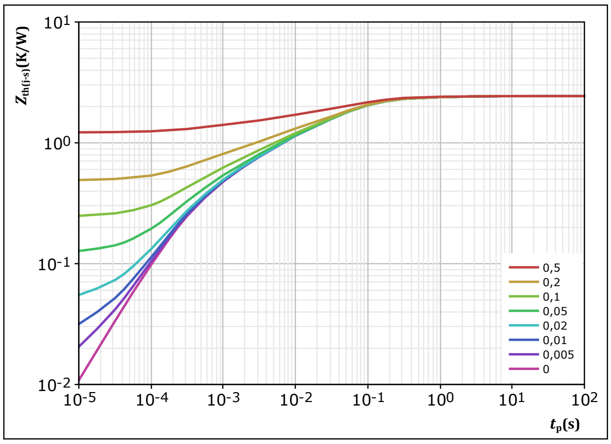
t_p =	250	μs
V_{CE} =	10	V

T_j: 25 °C, 125 °C

figure 14. **IGBT**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 2,438 K/W

IGBT thermal model values

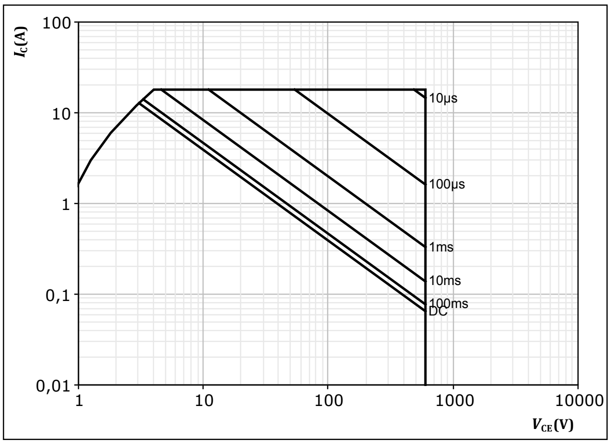
R (K/W)	τ (s)
7,91E-02	1,90E+00
2,81E-01	1,93E-01
9,46E-01	5,35E-02
4,95E-01	8,78E-03
3,46E-01	2,11E-03
2,91E-01	3,39E-04

Brake Switch Characteristics

figure 15.	**IGBT**

Safe operating area

I_C = f(V_{CE})



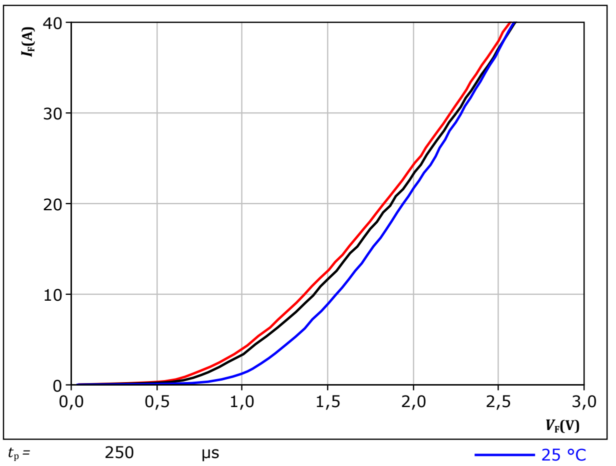
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Brake Diode Characteristics

figure 16. FWD

Typical forward characteristics

I_F = f(V_F)



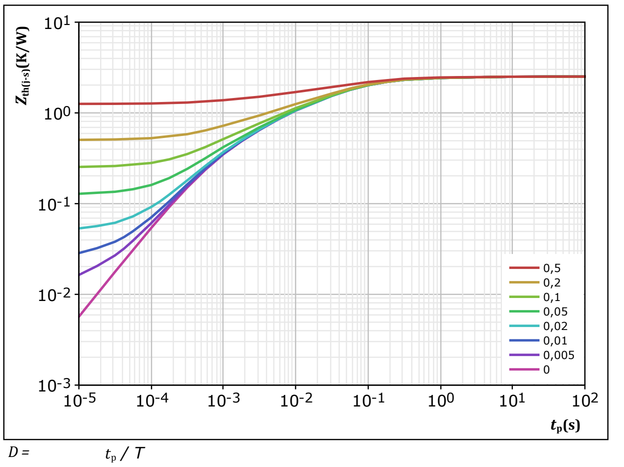
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 17. FWD

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 2,513 K/W

FWD thermal model values

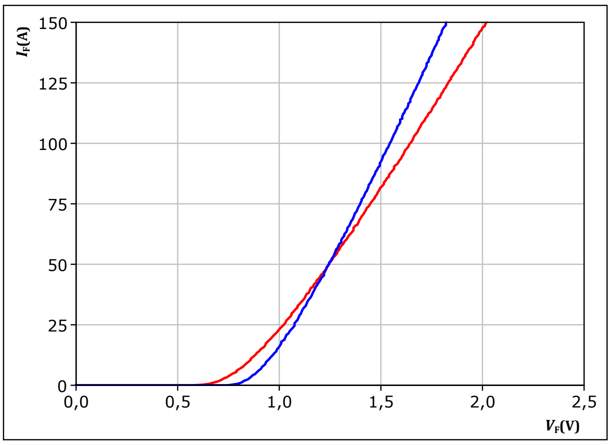
R (K/W)	τ (s)
9,70E-02	3,90E+00
2,83E-01	3,08E-01
8,79E-01	6,57E-02
5,75E-01	1,54E-02
4,51E-01	3,41E-03
2,27E-01	5,87E-04

Rectifier Diode Characteristics

figure 18.	Rectifier

Typical forward characteristics

I_F = f(V_F)



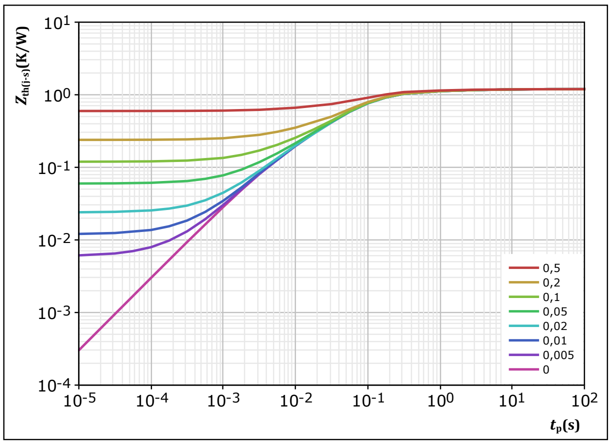
t_p = 250 µs

T_j: 25 °C, 125 °C

figure 19.	Rectifier

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,195 K/W

Rectifier thermal model values

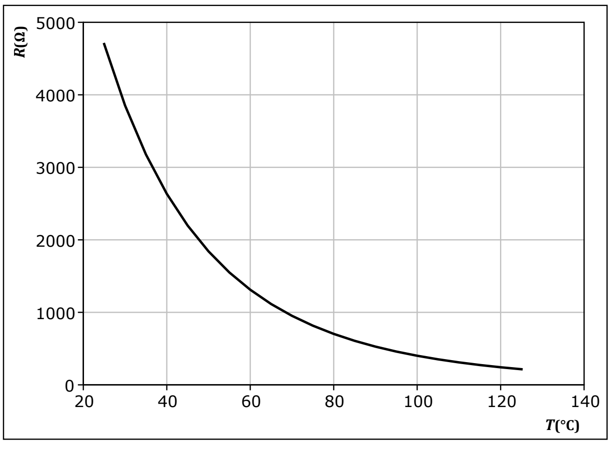
R (K/W)	τ (s)
4,87E-02	6,80E+00
1,57E-01	6,29E-01
7,33E-01	9,05E-02
1,69E-01	3,10E-02
7,37E-02	4,76E-03
1,39E-02	1,53E-02

Thermistor Characteristics

figure 20.	Thermistor

Typical NTC characteristic as function of temperature

R_T = f(T)

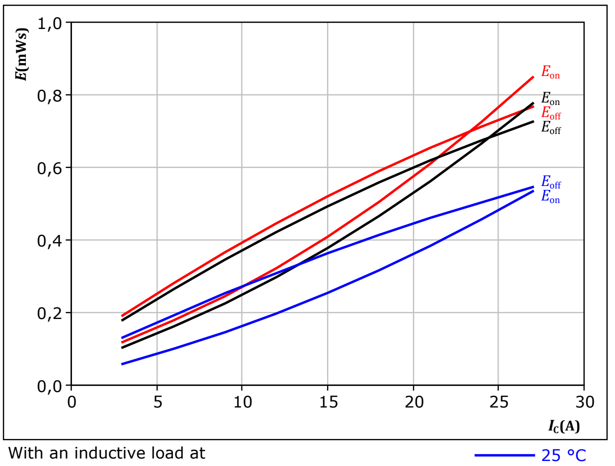


Inverter Switching Characteristics

figure 21. IGBT

Typical switching energy losses as a function of collector current

E = f(I_C)



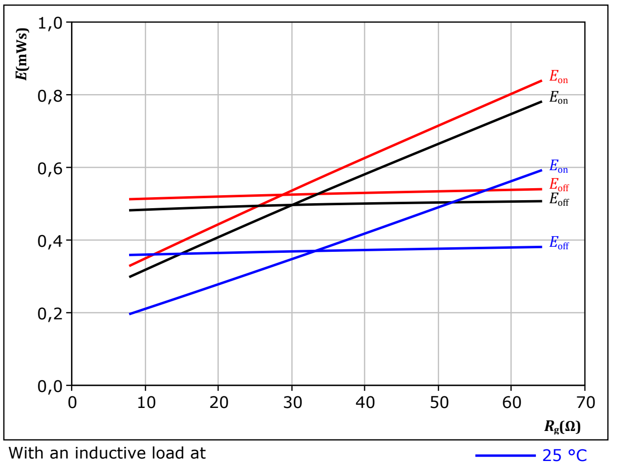
With an inductive load at

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 22. IGBT

Typical switching energy losses as a function of gate resistor

E = f(R_g)



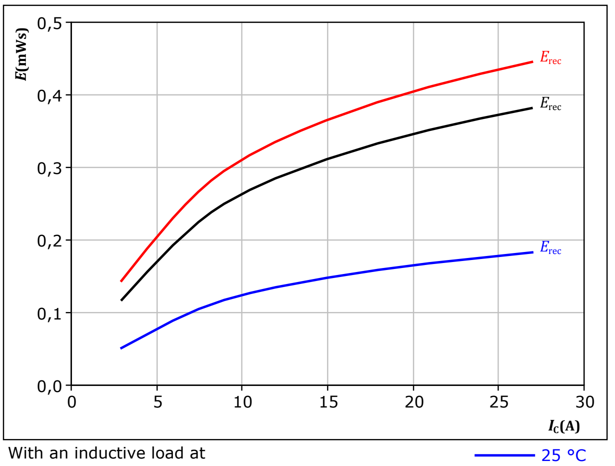
With an inductive load at

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

figure 23. FWD

Typical reverse recovered energy loss as a function of collector current

E_{rec} = f(I_C)



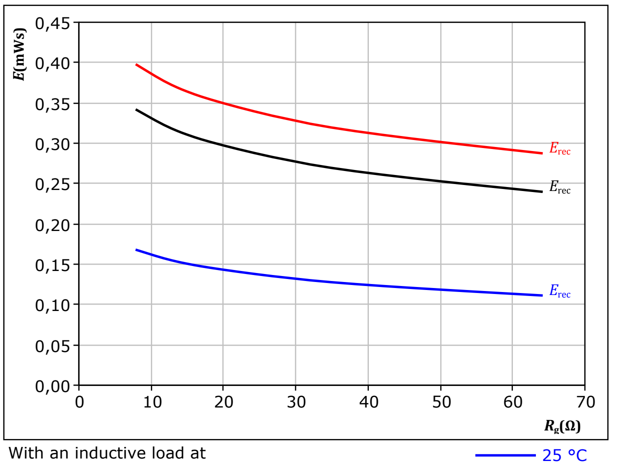
With an inductive load at

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

figure 24. FWD

Typical reverse recovered energy loss as a function of gate resistor

E_{rec} = f(R_g)



With an inductive load at

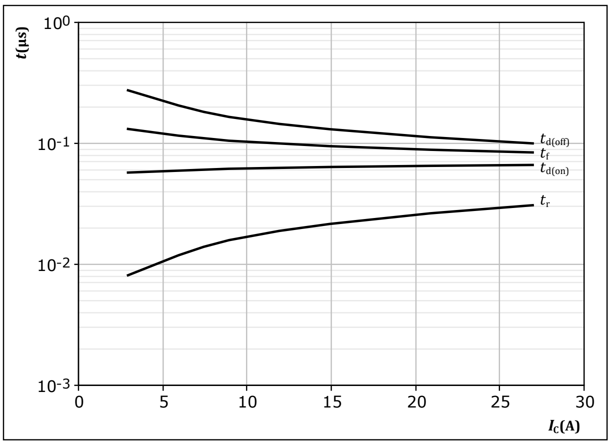
V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	15	A		150 °C

Inverter Switching Characteristics

figure 25. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



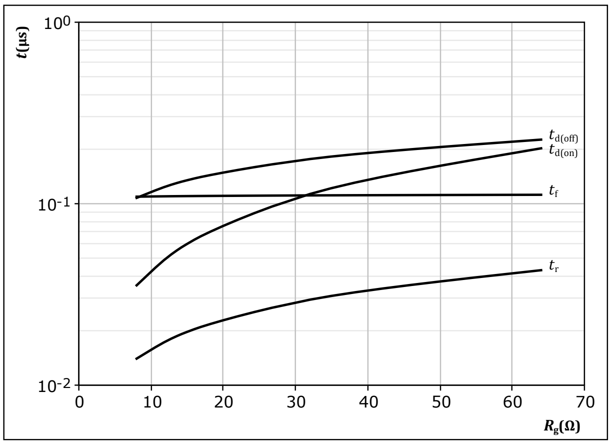
With an inductive load at

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

figure 26. **IGBT**

Typical switching times as a function of gate resistor

t = f(R_g)



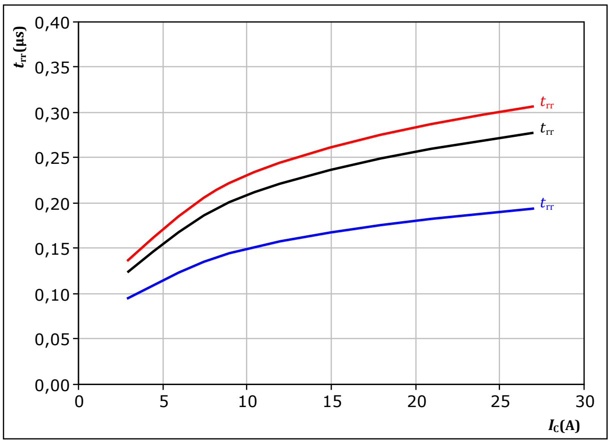
With an inductive load at

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

figure 27. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

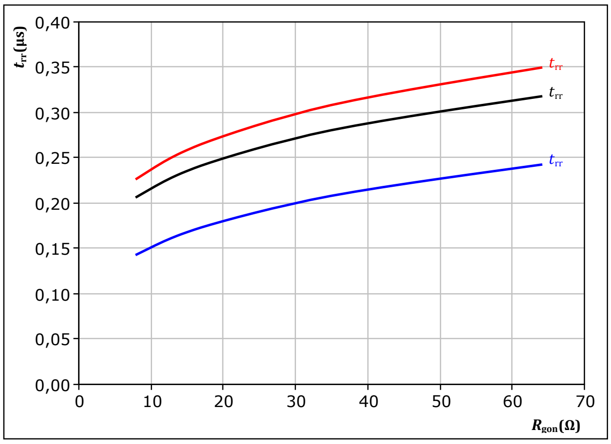
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	16	Ω

T_j: 25 °C, 125 °C, 150 °C

figure 28. **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} =	350	V
V_{GE} =	±15	V
I_C =	15	A

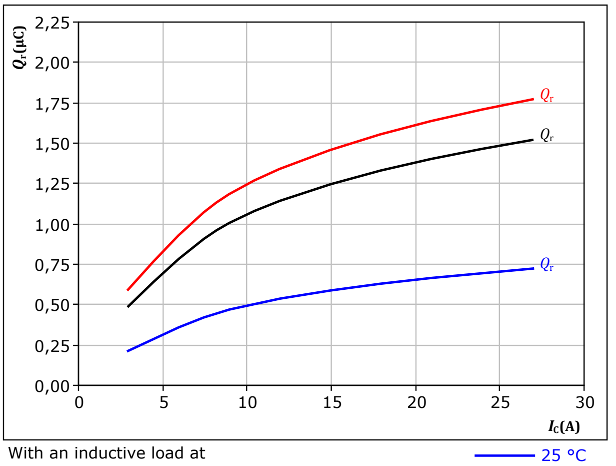
T_j: 25 °C, 125 °C, 150 °C

Inverter Switching Characteristics

figure 29. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



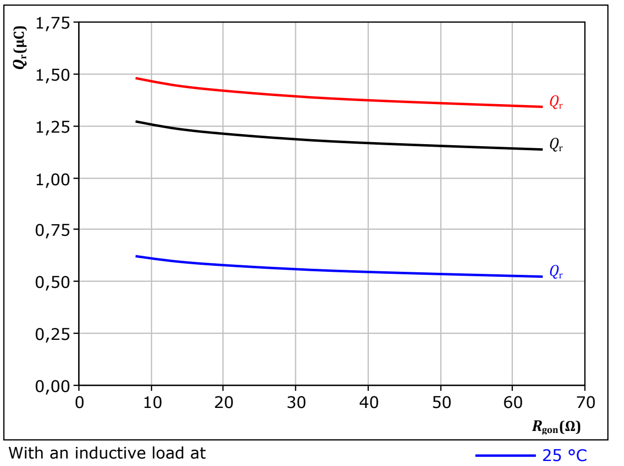
With an inductive load at

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

figure 30. **FWD**

Typical recovered charge as a function of turn on gate resistor

Q_r = f(R_{gon})



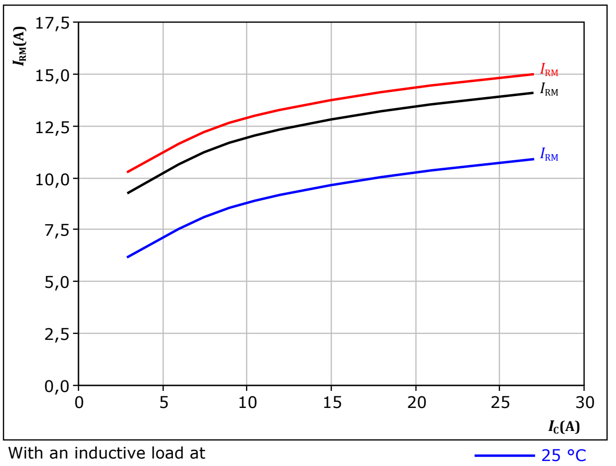
With an inductive load at

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

figure 31. **FWD**

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



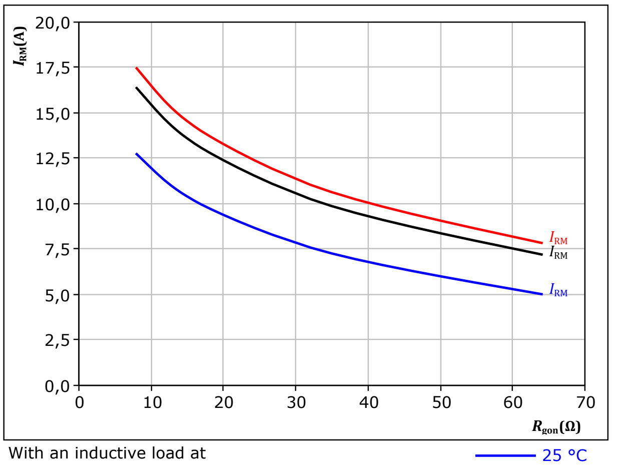
With an inductive load at

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

figure 32. **FWD**

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

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



With an inductive load at

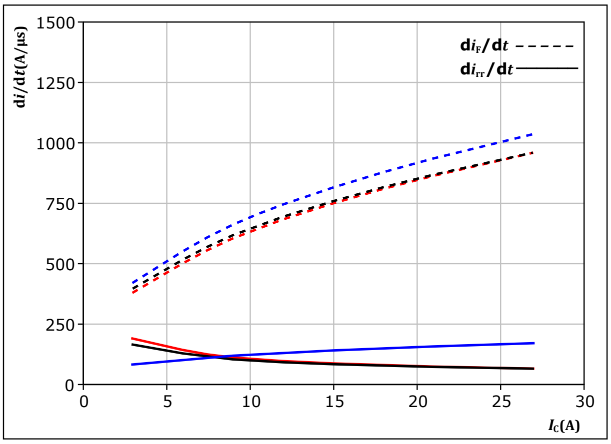
V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	15	A		150 °C

Inverter Switching Characteristics

figure 33. **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)



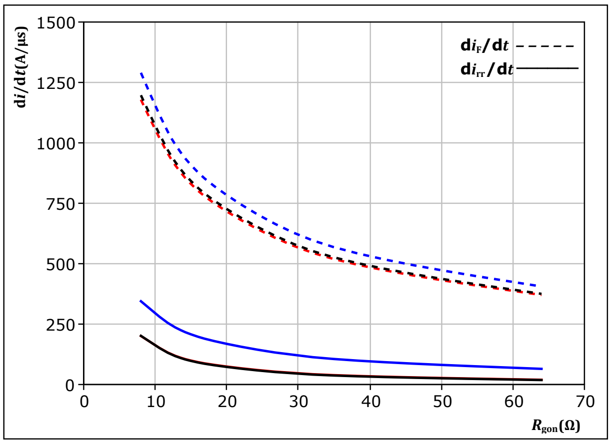
With an inductive load at

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

figure 34. **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})



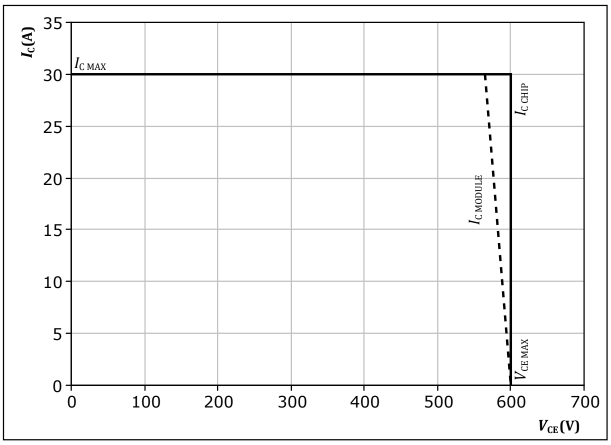
With an inductive load at

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

figure 35. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



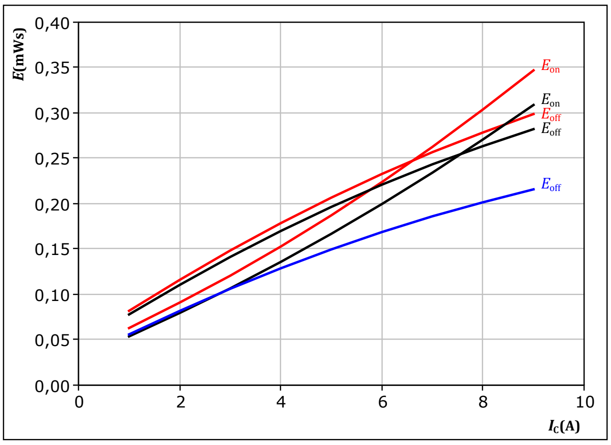
At			
	T_j =	150	°C
	R_{gon} =	16	Ω
	R_{goff} =	16	Ω

Brake Switching Characteristics

figure 36. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



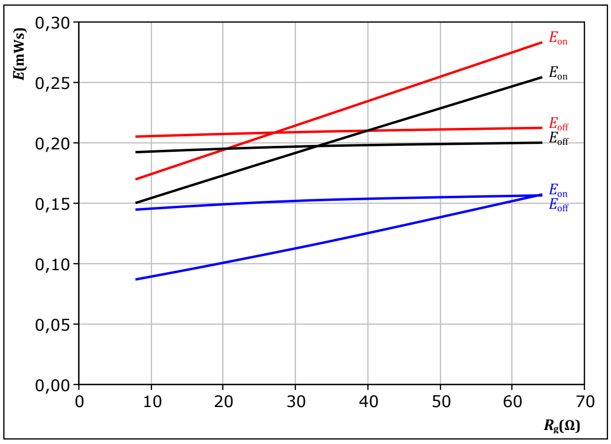
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	16	Ω		150 °C
R_{goff} =	16	Ω		

figure 37. **IGBT**

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



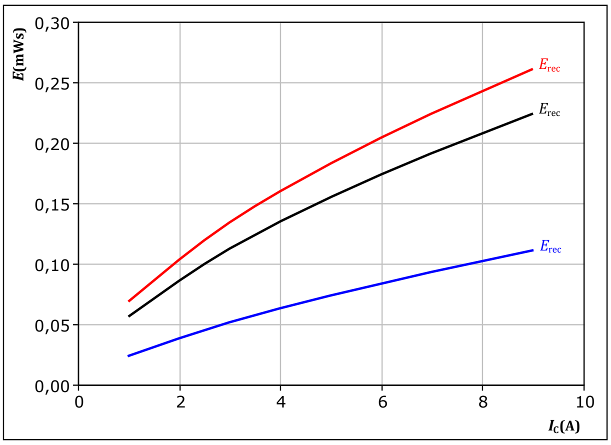
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	5	A		150 °C

figure 38. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



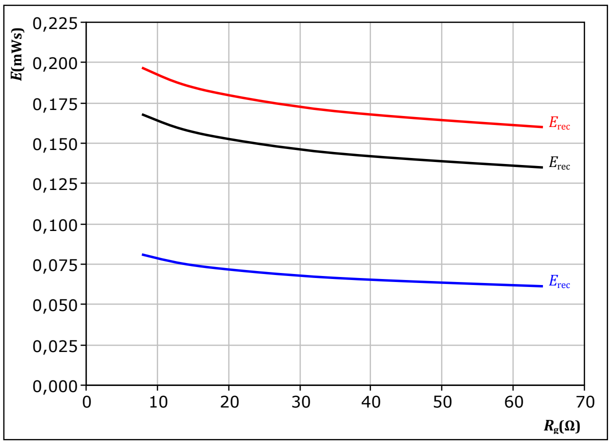
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 39. **FWD**

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at

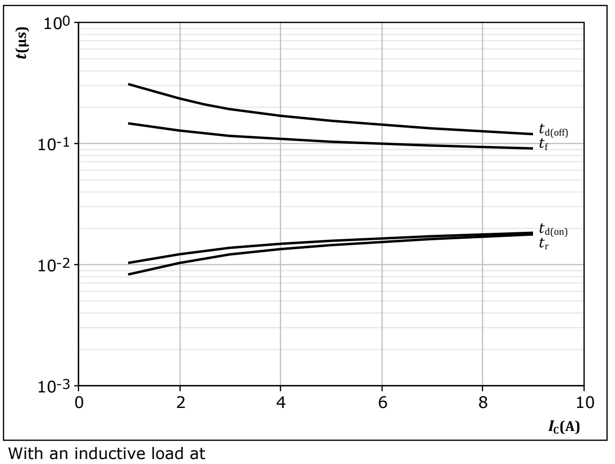
V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	5	A		150 °C

Brake Switching Characteristics

figure 40. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



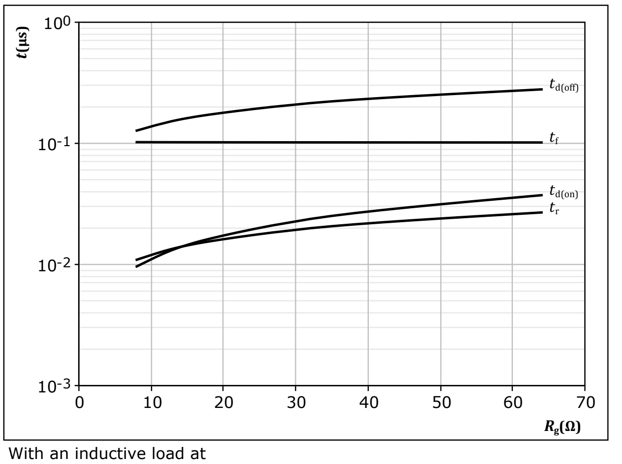
With an inductive load at

T_j =	150	°C
V_{CE} =	400	V
V_{GE} =	0/15	V
R_{gon} =	16	Ω
R_{goff} =	16	Ω

figure 41. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



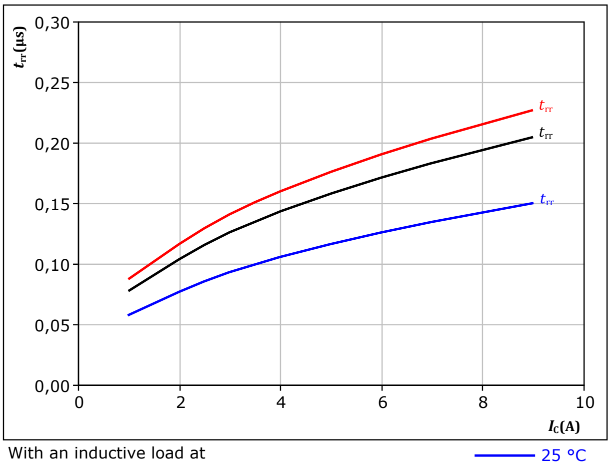
With an inductive load at

T_j =	150	°C
V_{CE} =	400	V
V_{GE} =	0/15	V
I_C =	5	A

figure 42. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$



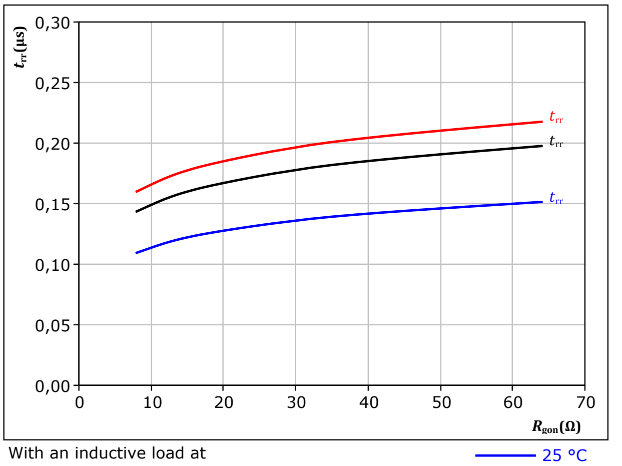
With an inductive load at

V_{CE} =	400	V
V_{GE} =	0/15	V
R_{gon} =	16	Ω

figure 43. **FWD**

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

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



With an inductive load at

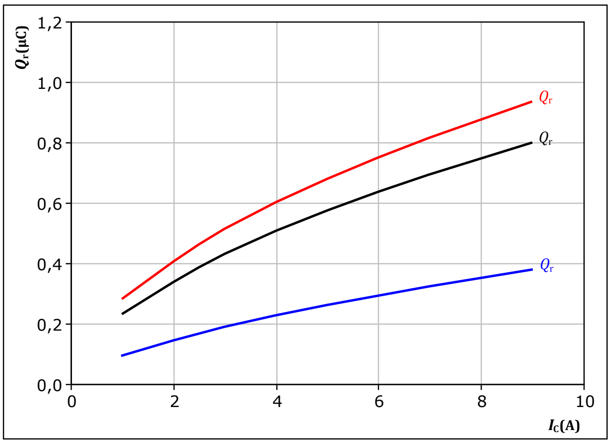
V_{CE} =	400	V
V_{GE} =	0/15	V
I_C =	5	A

Brake Switching Characteristics

figure 44. FWD

Typical recovered charge as a function of collector current

Q_r = f(I_C)



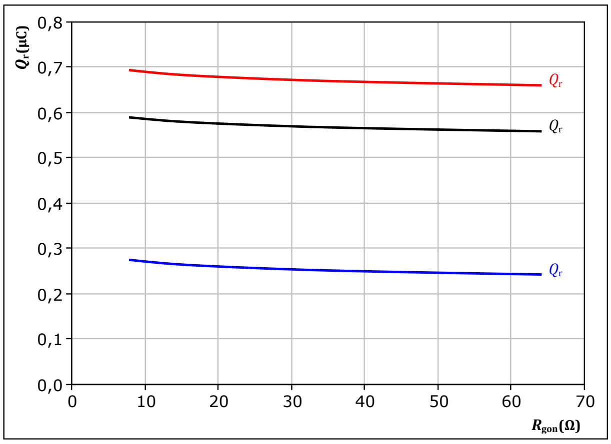
With an inductive load at

			T_j:
V_{CE} =	400	V	25 °C
V_{GE} =	0/15	V	125 °C
R_{gon} =	16	Ω	150 °C

figure 45. FWD

Typical recovered charge as a function of turn on gate resistor

Q_r = f(R_{gon})



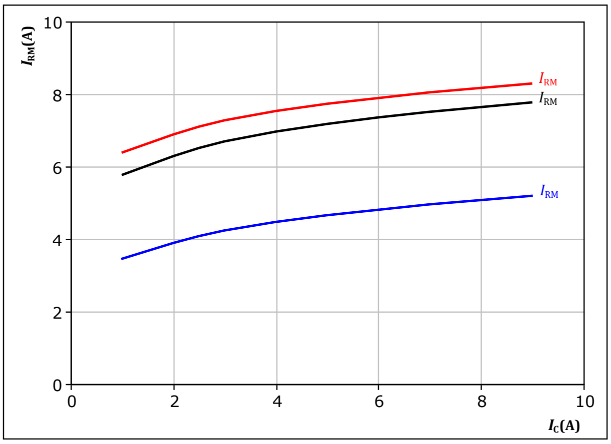
With an inductive load at

			T_j:
V_{CE} =	400	V	25 °C
V_{GE} =	0/15	V	125 °C
I_C =	5	A	150 °C

figure 46. FWD

Typical peak reverse recovery current as a function of collector current

I_{RM} = f(I_C)



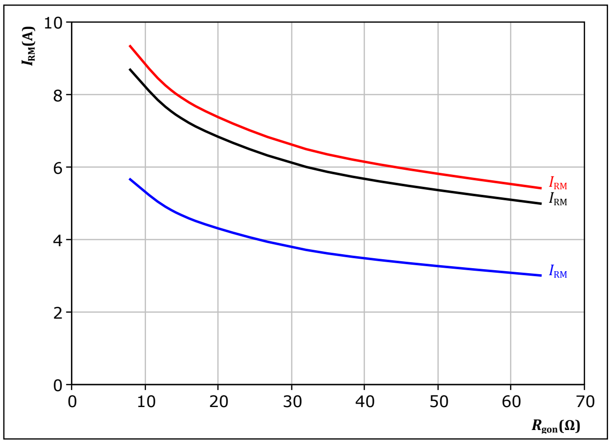
With an inductive load at

			T_j:
V_{CE} =	400	V	25 °C
V_{GE} =	0/15	V	125 °C
R_{gon} =	16	Ω	150 °C

figure 47. FWD

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

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



With an inductive load at

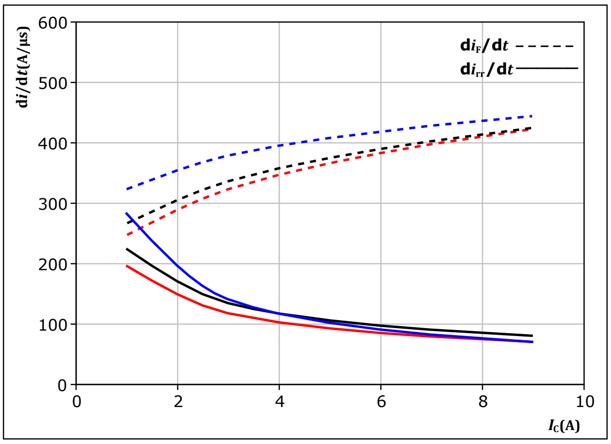
			T_j:
V_{CE} =	400	V	25 °C
V_{GE} =	0/15	V	125 °C
I_C =	5	A	150 °C

Brake Switching Characteristics

figure 48. **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)



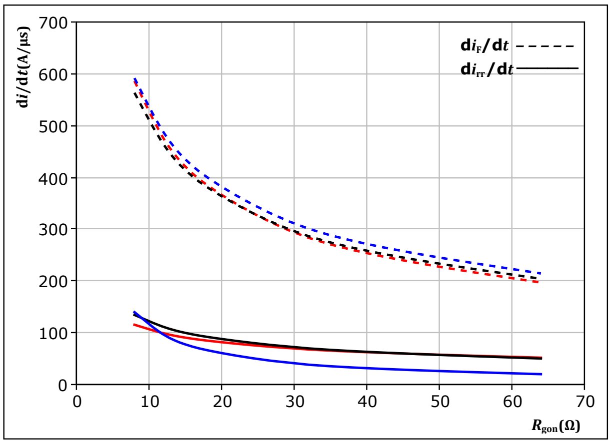
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
R_{gon} =	16	Ω		150 °C

figure 49. **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})



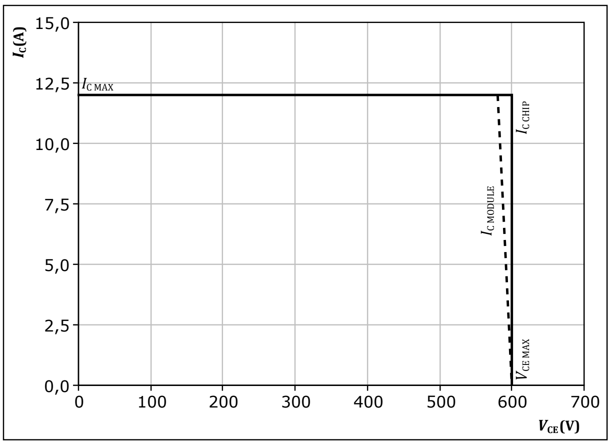
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C
V_{GE} =	0/15	V		125 °C
I_C =	5	A		150 °C

figure 50. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



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

Switching Definitions

figure 51. **IGBT**

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

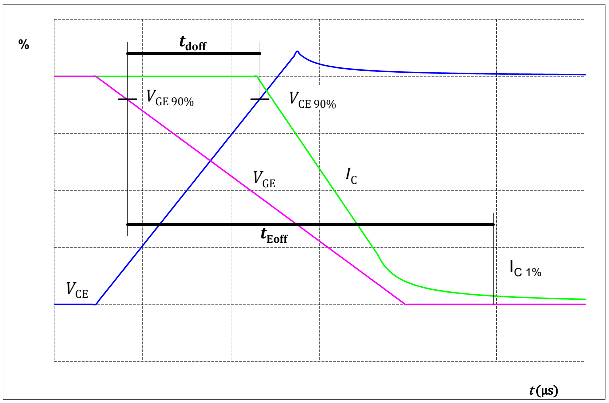


figure 52. **IGBT**

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

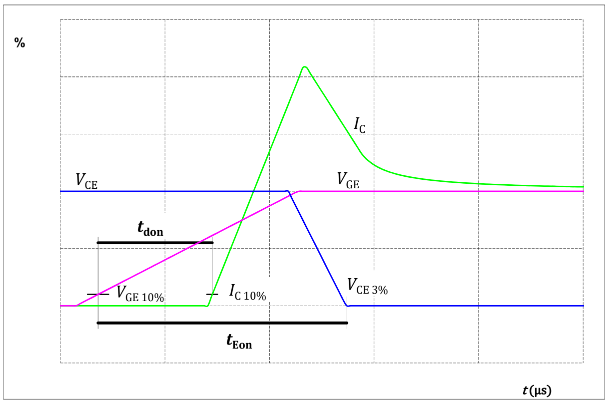


figure 53. **IGBT**

Turn-off Switching Waveforms & definition of t_f

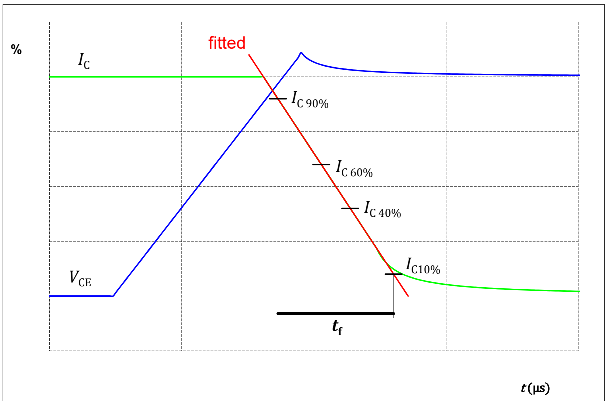
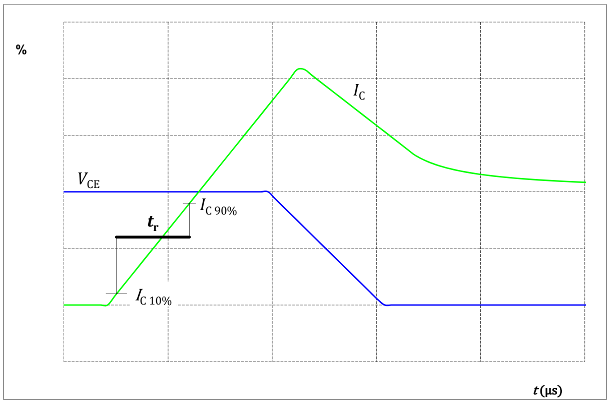


figure 54. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Switching Definitions

figure 55. FWD

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

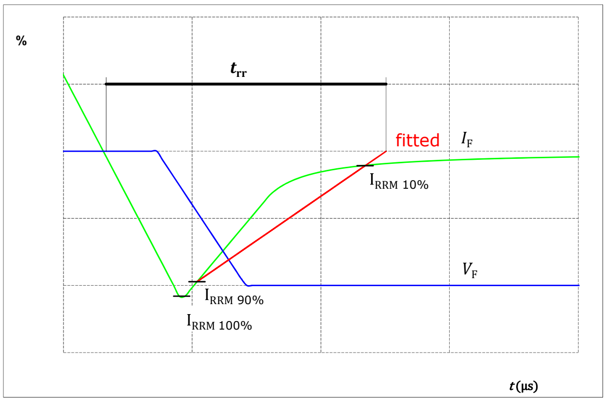
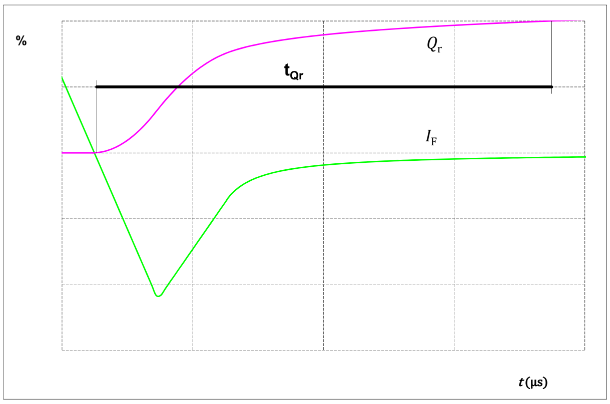


figure 56. FWD

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



V23990-P484-A39-PM
datasheet

Vincotech

Ordering Code

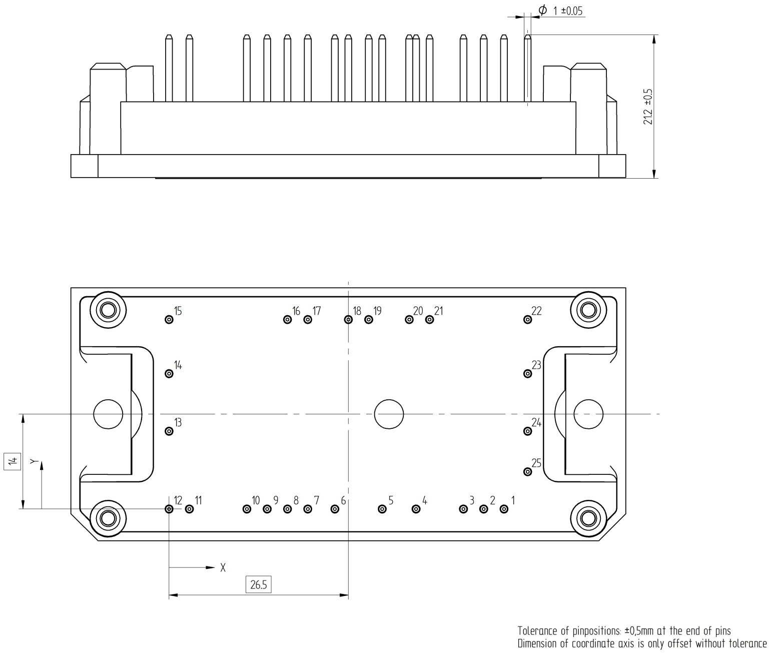
Version	Ordering Code
Without thermal paste	V23990-P484-A39-PM
With thermal paste	V23990-P484-A39-/3/-PM

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		

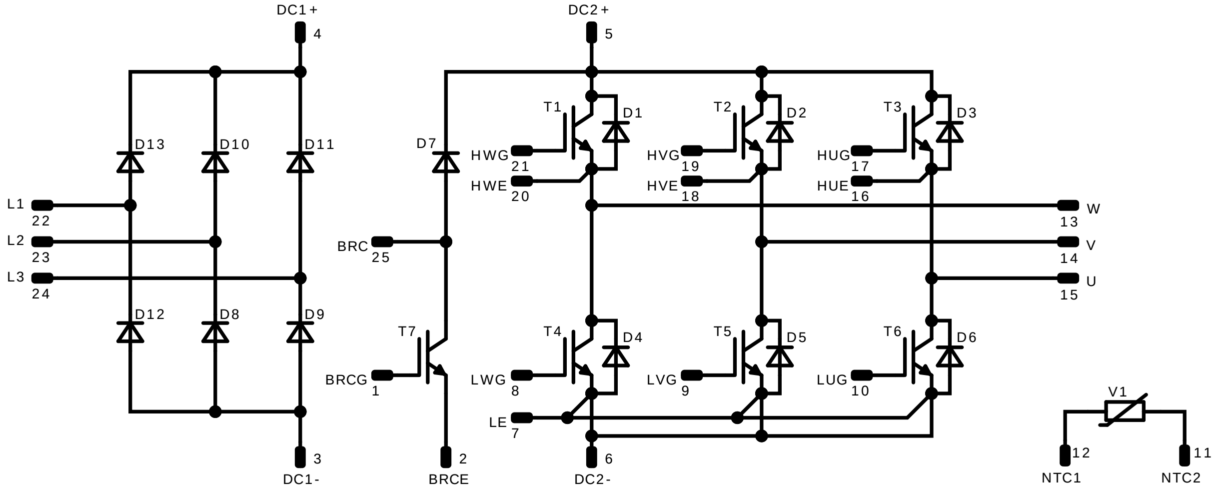
Outline

Pin table [mm]			
Pin	X	Y	Function
1	49,5	0	BRCG
2	46,5	0	BRCE
3	43,5	0	DC1-
4	36,5	0	DC1+
5	31,5	0	DC2+
6	24,5	0	DC2-
7	20,5	0	LE
8	17,5	0	LWG
9	14,5	0	LVG
10	11,5	0	LUG
11	3	0	NTC2
12	0	0	NTC1
13	0	11,5	W
14	0	20	V
15	0	28	U
16	17,5	28	HUE
17	20,5	28	HUG
18	26,5	28	HVE
19	29,5	28	HVG
20	35,5	28	HWE
21	38,5	28	HWG
22	53	28	L1
23	53	20	L2
24	53	11,5	L3
25	53	5,5	BRC



Vincotech

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T4, T1, T2, T5, T6, T3	IGBT	600 V	15 A	Inverter Switch	
D1, D4, D2, D5, D3, D6	FWD	600 V	20 A	Inverter Diode	
T7	IGBT	600 V	6 A	Brake Switch	
D7	FWD	600 V	15 A	Brake Diode	
D12, D13, D8, D10, D9, D11	Rectifier	1600 V	50 A	Rectifier Diode	
V1	Thermistor			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.

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-P484-A39-PM-D1-14	11 Dec. 2020		