30-FT12NMA160SH02-M669F28

datasheet

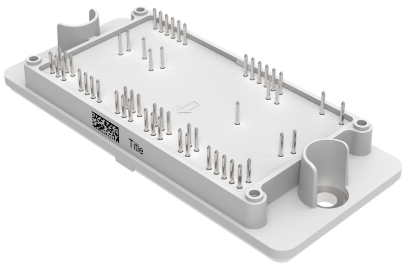
Vincotech

***flow*MNPC 2** **1200 V / 160 A**

Topology features

- Mixed Voltage Neutral Point Clamped Topology (T-Type)
- Kelvin Emitter for improved switching performance
- Split output for elimination of X-conduction at fast turn-on
- Low inductive commutation loop
- Temperature sensor

flow 2 13 mm housing



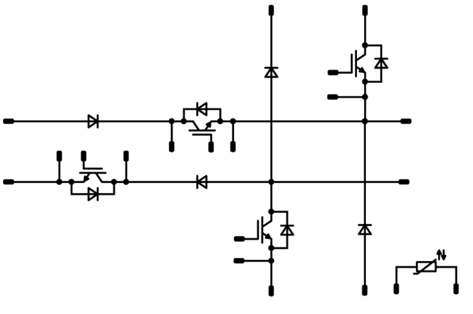
Component features

- Easy paralleling
- High speed switching
- Low switching losses

Housing features

- Base isolation: Al_2O_3
- Convex shaped baseplate for superior thermal contact
- Cu baseplate
- Thermo-mechanical push-and-pull force relief
- Solder pin

Schematic



Target applications

- Solar inverter
- UPS
- Active frontend

Types

- 30-FT12NMA160SH02-M669F28

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Buck Switch					
Collector-emitter voltage	V_{CES}			1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	178	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		480	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	447	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
Buck Diode					
Peak repetitive reverse voltage	V_{RRM}			650	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	110	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		450	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	142	W
Maximum junction temperature	T_{jmax}			175	°C
Buck Sw. Protection Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s <= 80 °C	20 (1)	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	56	W
Maximum junction temperature	T_{jmax}			175	°C

(1) limited by I_{FRM}

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Boost Switch					
Collector-emitter voltage	V_{CES}			650	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$	T_s = 80 °C	92	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}		300	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	145	W
Gate-emitter voltage	V_{GES}			±20	V
Maximum junction temperature	T_{jmax}			175	°C
Boost Diode					
Peak repetitive reverse voltage	V_{RRM}			1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$	T_s = 80 °C	61	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, t_p = 10 ms	T_j = 150 °C	340	A
Surge current capability	I^2t			580	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	139	W
Maximum junction temperature	T_{jmax}			175	°C
Boost Sw. Protection 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
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}		60	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$	T_s = 80 °C	59	W
Maximum junction temperature	T_{jmax}			175	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Conditions		Value	Unit
Module Properties					
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{jop}			-40…+(T_{jmax} - 25)	°C
Isolation Properties					
Isolation voltage	V_{isol}	DC Test Voltage*	t_p = 2 s	6000	V
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]	Values Min	Values Typ	Values Max	Unit
Buck Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,006	25	5,3	5,8	6,3	V
Collector-emitter saturation voltage	V_{CEsat}		15		160	25 125 150	1,78	1,94 2,23 2,32	2,42[2]	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			20	µA
Gate-emitter leakage current	I_{GES}		20	0		25			480	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		9320		pF
Output capacitance	C_{oes}							600		pF
Reverse transfer capacitance	C_{res}							520		pF
Gate charge	Q_g	V_{CC} = 960 V	15		160	25		740		nC
Thermal										
Thermal resistance junction to sink[3]	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,21		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	±15	350	80	25 125 150		132,48 132,48 131,52		ns
Rise time	t_r					25 125 150		22,72 26,24 27,2		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		215,04 293,44 311,36		ns
Fall time	t_f					25 125 150		41,69 97,55 114,57		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=2,54 µC Q_{rFWD}=5,51 µC Q_{rFWD}=6,46 µC				25 125 150		1,37 2,15 2,4		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		2,44 4,65 5,33		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	
Buck Diode										
Static										
Forward voltage	V_F				150	25 125 150		1,53 1,49 1,47	1,92(2)	V
Reverse leakage current	I_R	V_r = 650 V				25			7,6	µA
Thermal										
Thermal resistance junction to sink(3)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,67		K/W
Dynamic										
Peak recovery current	I_{RM}	d*i*/d*t*=4251 A/µs d*i*/d*t*=3763 A/µs d*i*/d*t*=3925 A/µs	±15	350	80	25 125 150		61,93 88,59 94,22		A
Reverse recovery time	t_{rr}					25 125 150		61,9 94,72 106,85		ns
Recovered charge	Q_r					25 125 150		2,54 5,51 6,46		µC
Reverse recovered energy	E_{rec}					25 125 150		0,478 1,05 1,2		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		1800 1442 1087		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	
Buck Sw. Protection Diode										
Static										
Forward voltage	V_F				10	25 125 150	1,35	1,79 1,77 1,73	2,05(2)	V
Reverse leakage current	I_R	V_r = 1200 V				25			2,7	µA
Thermal										
Thermal resistance junction to sink(3)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,68		K/W

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
Boost Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,001	25	3,2	4	4,8	V
Collector-emitter saturation voltage	V_{CEsat}		15		100	25 125 150		1,41 1,55 1,58	1,75(2)	V
Collector-emitter cut-off current	I_{CES}		0	650		25			100	µA
Gate-emitter leakage current	I_{GES}		20	0		25			200	nA
Internal gate resistance	r_g							None		Ω
Input capacitance	C_{ies}	f = 1 Mhz	0	25		25		6200		pF
Output capacitance	C_{oes}							176		pF
Reverse transfer capacitance	C_{res}							24		pF
Gate charge	Q_g	V_{CC} = 520 V	15		100	25		240		nC
Thermal										
Thermal resistance junction to sink(3)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,65		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{gon} = 4 Ω R_{goff} = 4 Ω	-5/15	350	70	25 125 150		30,22 30,56 30,53		ns
Rise time	t_r					25 125 150		6,25 7,84 8,21		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		107,44 129,88 136,16		ns
Fall time	t_f					25 125 150		9,1 24,63 33,12		ns
Turn-on energy (per pulse)	E_{on}	Q_{rFWD}=2,75 µC Q_{rFWD}=4,16 µC Q_{rFWD}=4,77 µC				25 125 150		0,48 0,689 0,762		mWs
Turn-off energy (per pulse)	E_{off}					25 125 150		0,698 1,22 1,38		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				70	25 125 150		2,28 2,41 2,37	2,62(2) 2,62(2)	V
Reverse leakage current	I_R	V_r = 1200 V				25 150		 5400	120 11000	µA
Thermal										
Thermal resistance junction to sink(3)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						0,68		K/W
Dynamic										
Peak recovery current	I_{RM}	d*i*/d*t*=8200 A/µs d*i*/d*t*=8120 A/µs d*i*/d*t*=7475 A/µs	-5/15	350	70	25 125 150		158,71 178,48 188,65		A
Reverse recovery time	t_{rr}					25 125 150		31,75 41,02 44,88		ns
Recovered charge	Q_r					25 125 150		2,75 4,16 4,77		µC
Reverse recovered energy	E_{rec}					25 125 150		0,477 0,751 0,872		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125 150		14499,16 12390,67 12181,83		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 Sw. Protection Diode										
Static										
Forward voltage	V_F				30	25 125	1,23	1,7 1,59	1,87(2)	V
Reverse leakage current	I_R	V_r = 650 V				25			0,36	µA
Thermal										
Thermal resistance junction to sink(3)	$R_{th(j-s)}$	λ_{paste} = 3,4 W/mK (PSX)						1,61		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	

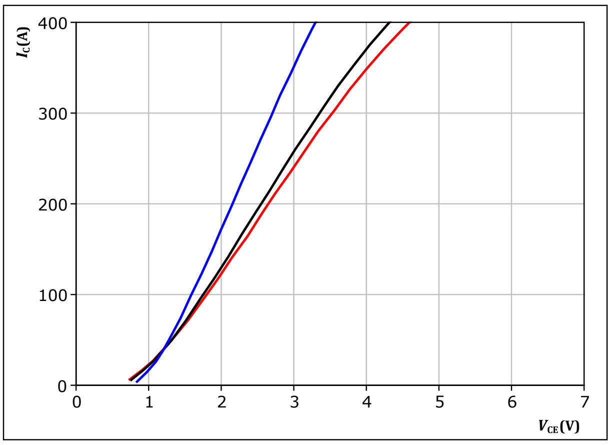
(2) Value at chip level
(3) Only valid with pre-applied Vincotech thermal interface material.

Buck Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

I_C = f(V_{CE})

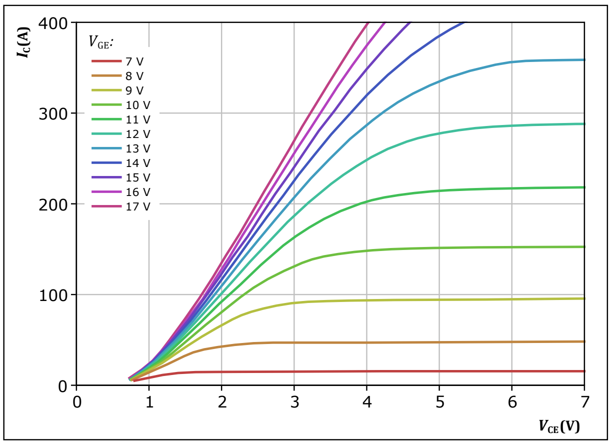


t_p =	250	μs		25 °C
V_{GE} =	15	V	T_j:	125 °C
				150 °C

figure 2. **IGBT**

Typical output characteristics

I_C = f(V_{CE})



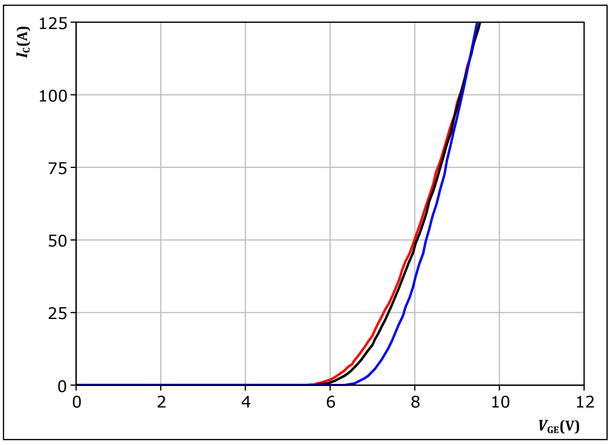
t_p =	250	μs
T_j =	150	°C

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

figure 3. **IGBT**

Typical transfer characteristics

I_C = f(V_{GE})

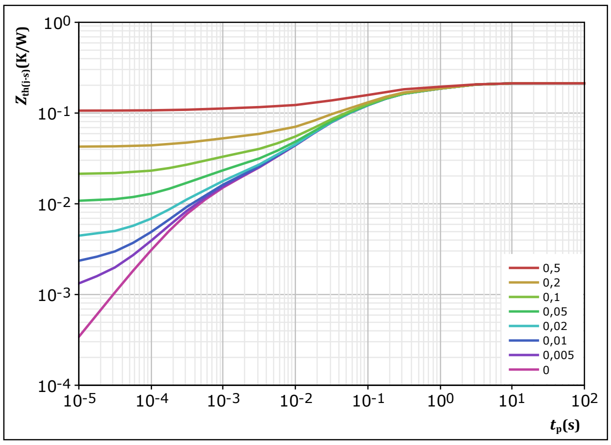


t_p =	250	μs		25 °C
V_{CE} =	10	V	T_j:	125 °C
				150 °C

figure 4. **IGBT**

Transient thermal impedance as a function of pulse width

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



D =	t_p / T	
$R_{th(j-s)}$ =	0,213	K/W

IGBT thermal model values

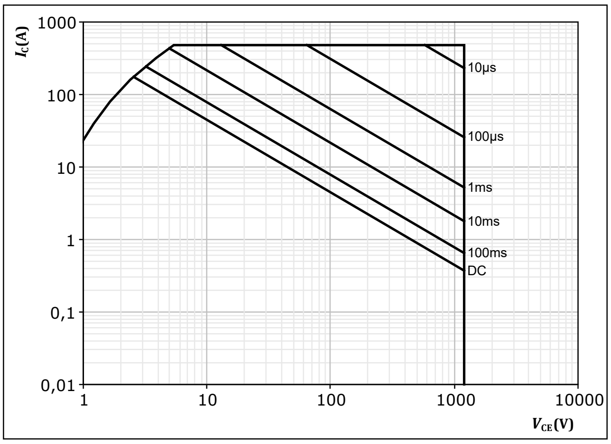
R (K/W)	τ (s)
5,20E-02	1,51E+00
9,57E-02	1,22E-01
4,99E-02	1,80E-02
8,04E-03	1,08E-03
7,07E-03	2,99E-04

Buck Switch Characteristics

figure 5.	**IGBT**

Safe operating area

I_C = f(V_{CE})



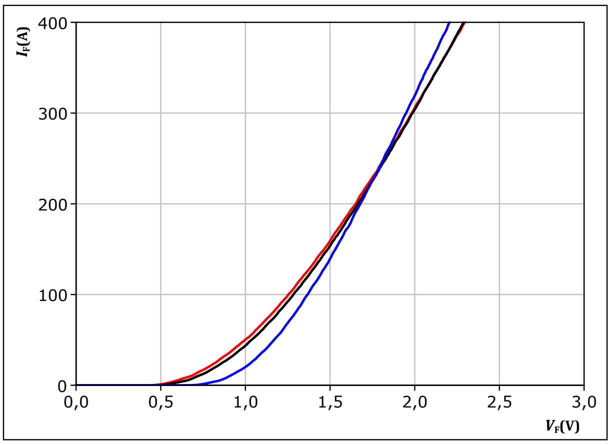
D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

Buck Diode Characteristics

figure 6. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



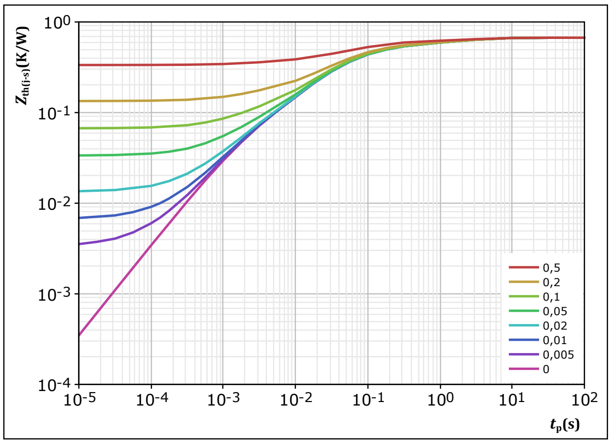
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 7. **FWD**

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 0,67 K/W

FWD thermal model values

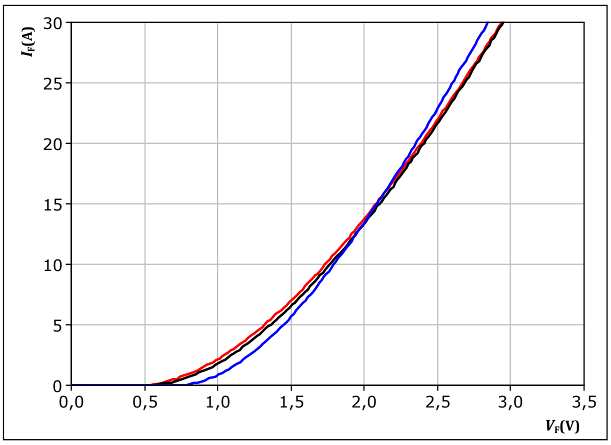
R (K/W)	τ (s)
8,21E-02	3,29E+00
8,71E-02	5,92E-01
2,69E-01	7,96E-02
1,91E-01	2,03E-02
4,05E-02	1,85E-03

Buck Sw. Protection Diode Characteristics

figure 8. FWD

Typical forward characteristics

$I_F = f(V_F)$



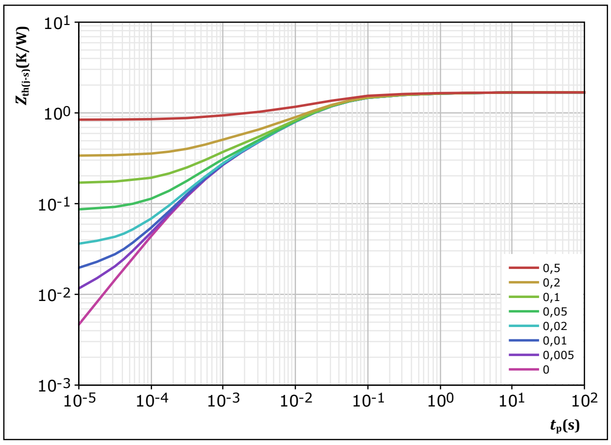
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 9. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)}$ = 1,683 K/W

FWD thermal model values

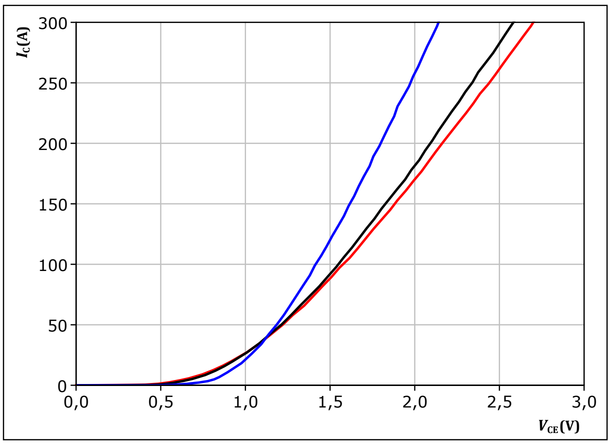
R (K/W)	τ (s)
6,27E-02	2,99E+00
1,53E-01	2,72E-01
5,57E-01	4,10E-02
4,90E-01	1,29E-02
2,45E-01	3,00E-03
1,75E-01	5,24E-04

Boost Switch Characteristics

figure 10. IGBT

Typical output characteristics

I_C = f(V_{CE})

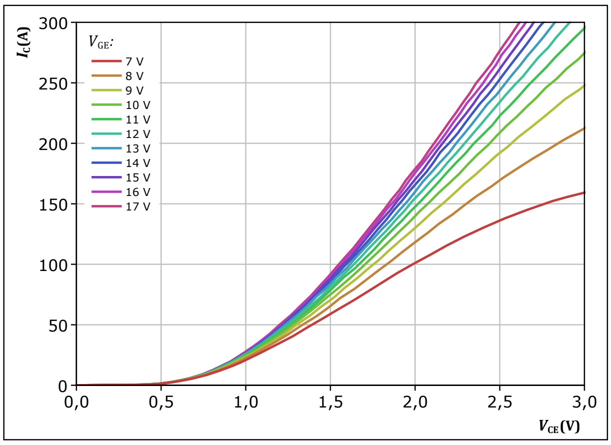


t_p = 250 µs
V_{GE} = 15 V
T_j: 25 °C, 125 °C, 150 °C

figure 11. IGBT

Typical output characteristics

I_C = f(V_{CE})

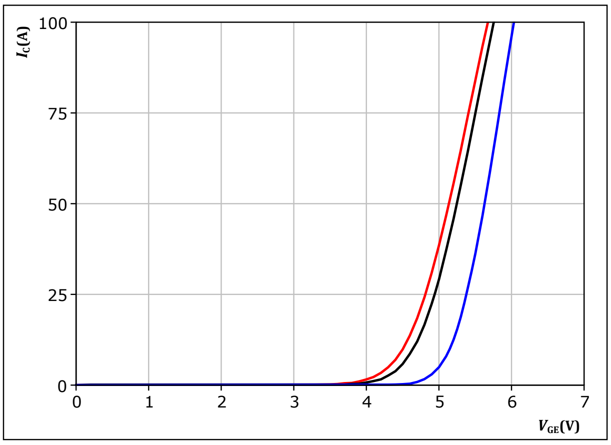


t_p = 250 µs
T_j = 150 °C
V_{GE} from 7 V to 17 V in steps of 1 V

figure 12. IGBT

Typical transfer characteristics

I_C = f(V_{GE})

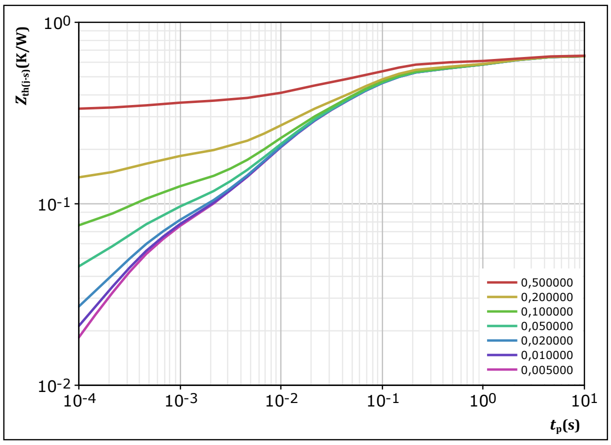


t_p = 250 µs
V_{CE} = 38 V
T_j: 25 °C, 125 °C, 150 °C

figure 13. IGBT

Transient thermal impedance as a function of pulse width

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



D = t_p / T
$R_{th(j-s)}$ = 0,655 K/W

IGBT thermal model values

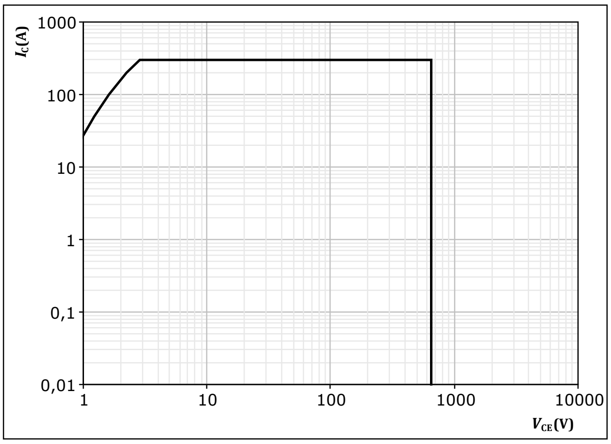
R (K/W)	τ (s)
1,17E-02	4,29E+01
1,21E-01	1,52E+00
3,07E-01	6,92E-02
1,63E-01	9,56E-03
5,75E-02	3,58E-04

Boost Switch Characteristics

figure 14. **IGBT**

Safe operating area

I_C = f(V_{CE})

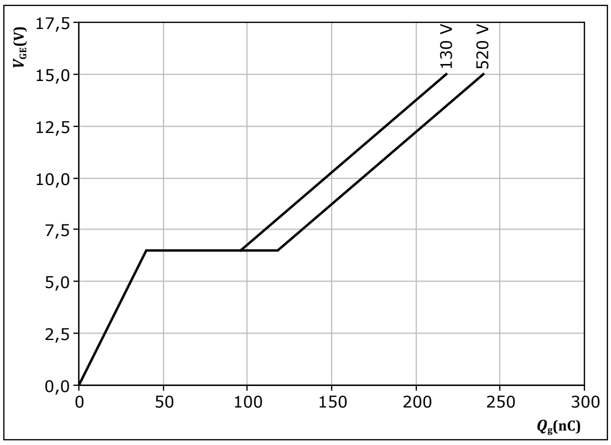


D =	single pulse	
T_s =	80	°C
V_{GE} =	15	V
T_j =	T_{jmax}	

figure 15. **IGBT**

Gate voltage vs gate charge

V_{GE} = f(Q_g)



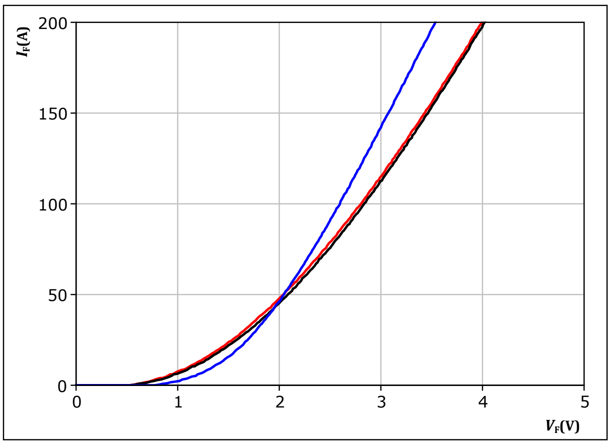
I_C =	100	A
T_j =	25	°C

Boost Diode Characteristics

figure 16. FWD

Typical forward characteristics

$I_F = f(V_F)$



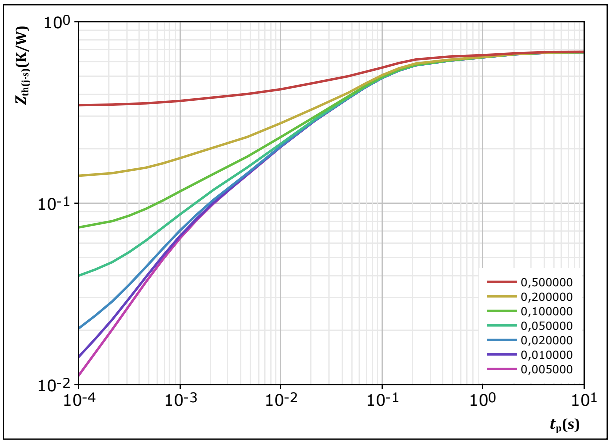
t_p = 250 µs

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

$R_{th(j-s)}$ = 0,683 K/W

FWD thermal model values

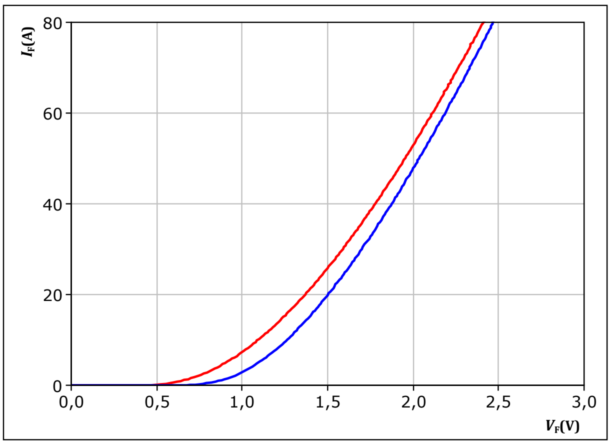
R (K/W)	τ (s)
1,41E-02	3,15E+01
9,87E-02	1,07E+00
3,84E-01	7,20E-02
1,28E-01	8,29E-03
6,35E-02	8,88E-04

Boost Sw. Protection Diode Characteristics

figure 18. **FWD**

Typical forward characteristics

I_F = f(V_F)



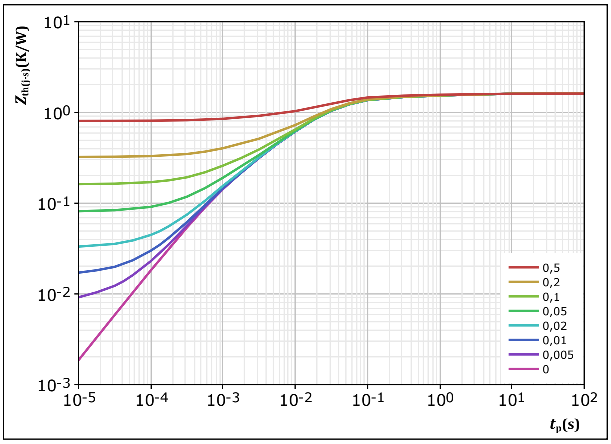
t_p = 250 μs

T_j: 25 °C, 125 °C

figure 19. **FWD**

Transient thermal impedance as a function of pulse width

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



D = t_p / T

$R_{th(j-s)}$ = 1,614 K/W

FWD thermal model values

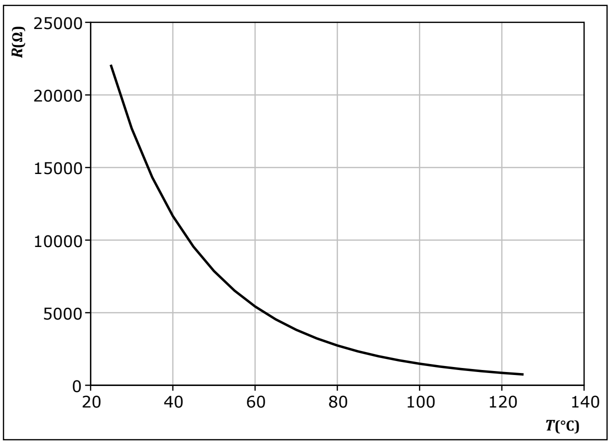
R (K/W)	τ (s)
1,05E-01	3,05E+00
1,86E-01	2,04E-01
8,60E-01	3,00E-02
3,40E-01	8,15E-03
1,24E-01	1,07E-03

Thermistor Characteristics

figure 20. **Thermistor**

Typical NTC characteristic as function of temperature

R_T = f(T)

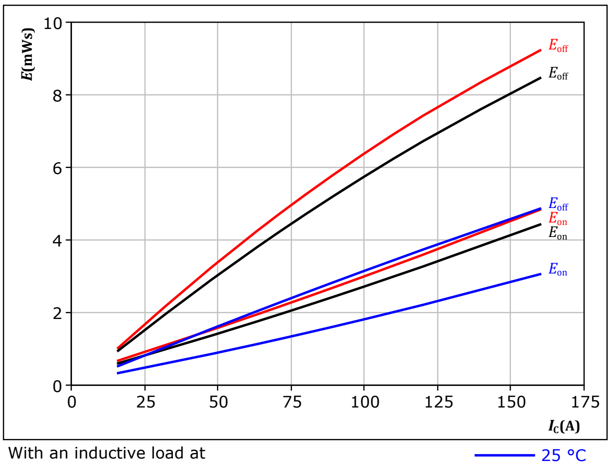


Buck Switching Characteristics

figure 21. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



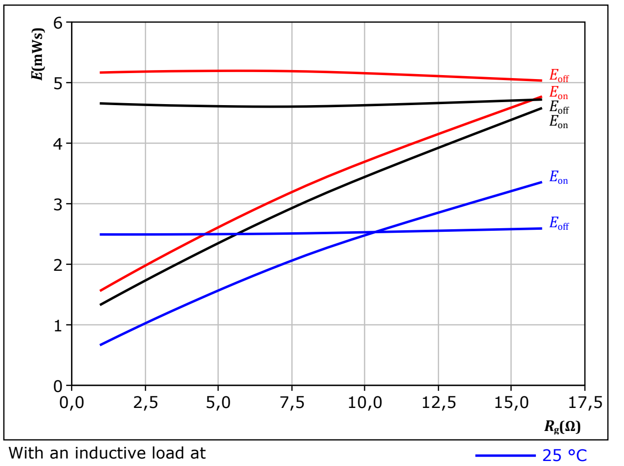
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	4	Ω		150 °C
R_{goff} =	4	Ω		

figure 22. **IGBT**

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

$E = f(R_g)$



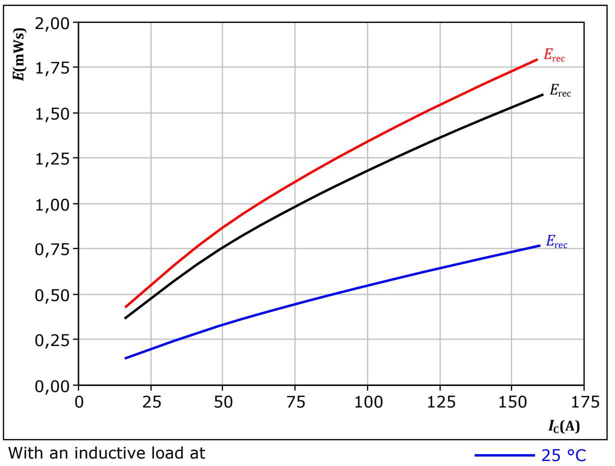
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	80	A		150 °C

figure 23. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



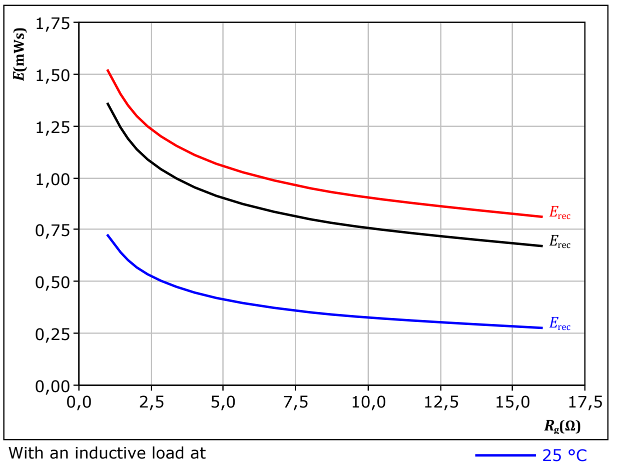
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 24. **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

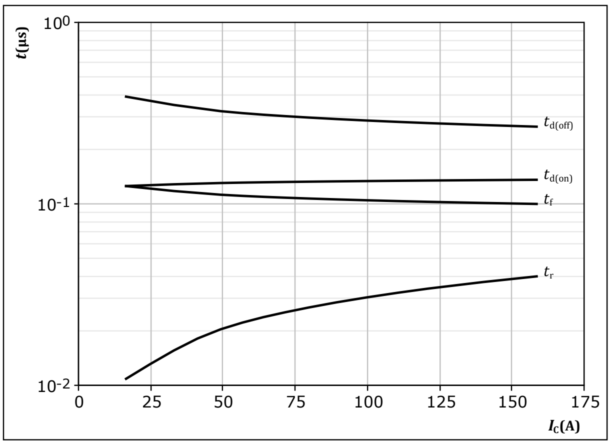
V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	80	A		150 °C

Buck Switching Characteristics

figure 25. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



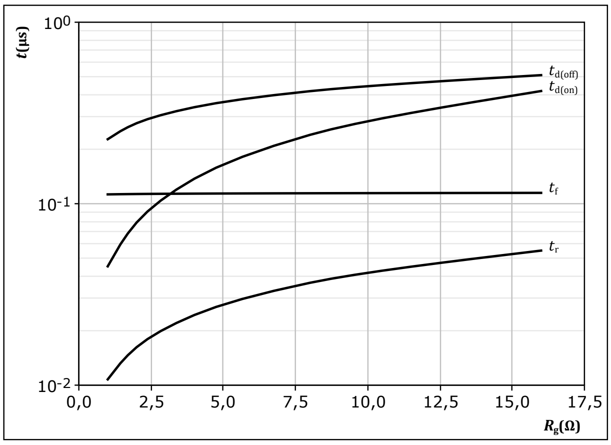
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 26. **IGBT**

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

t = f(R_g)



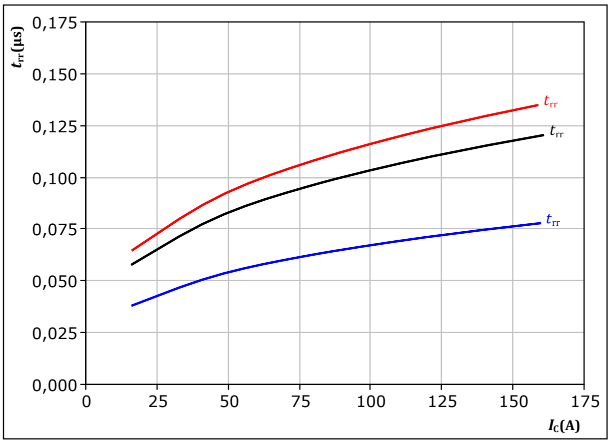
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	±15	V
I_C =	80	A

figure 27. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

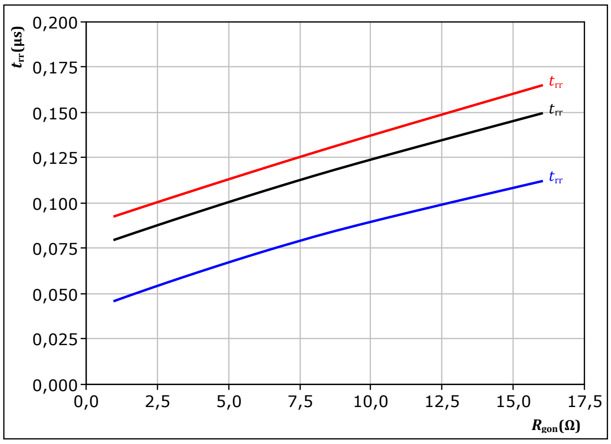
V_{CE} =	350	V
V_{GE} =	±15	V
R_{gon} =	4	Ω

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 =	80	A

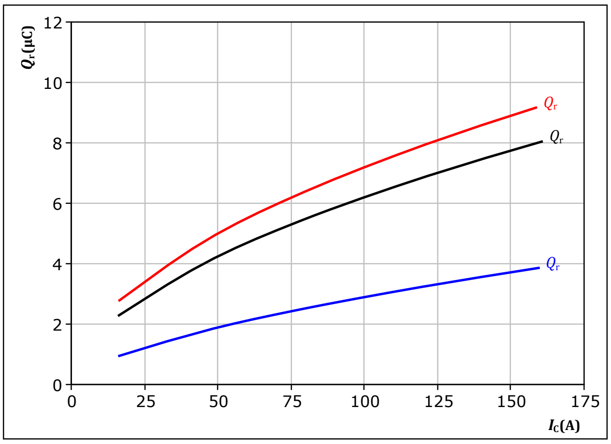
T_j: 25 °C, 125 °C, 150 °C

Buck Switching Characteristics

figure 29. **FWD**

Typical recovered charge as a function of collector current

Q_r = f(I_C)



With an inductive load at

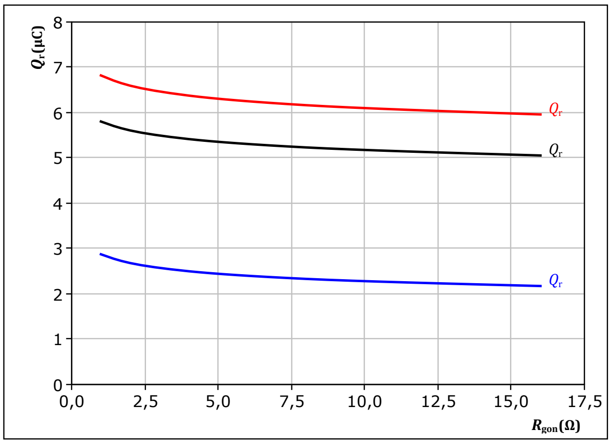
V_{CE} =	350	V	
V_{GE} =	±15	V	
R_{gon} =	4	Ω	

T_j: 25 °C, 125 °C, 150 °C

figure 30. **FWD**

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

Q_r = f(R_{gon})



With an inductive load at

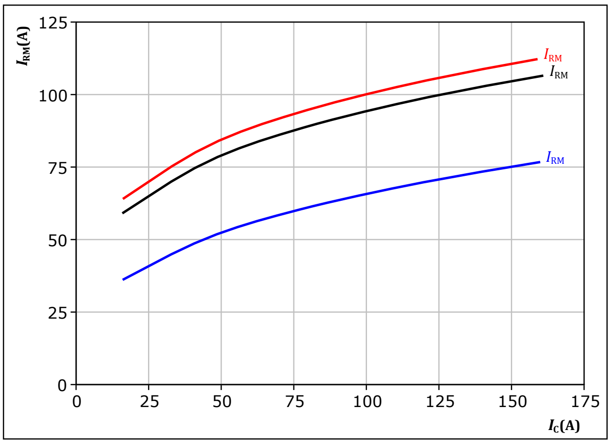
V_{CE} =	350	V	
V_{GE} =	±15	V	
I_C =	80	A	

T_j: 25 °C, 125 °C, 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

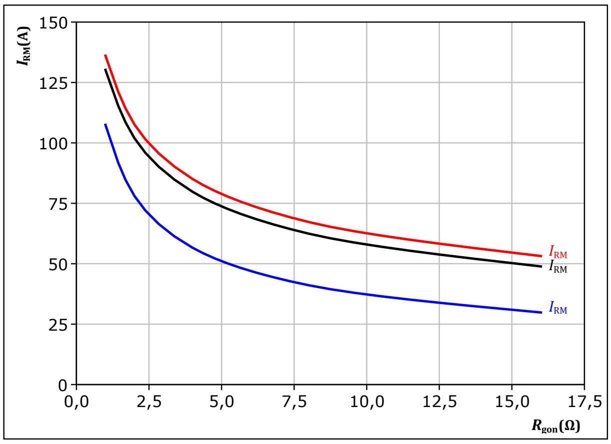
V_{CE} =	350	V	
V_{GE} =	±15	V	
R_{gon} =	4	Ω	

T_j: 25 °C, 125 °C, 150 °C

figure 32. **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} =	350	V	
V_{GE} =	±15	V	
I_C =	80	A	

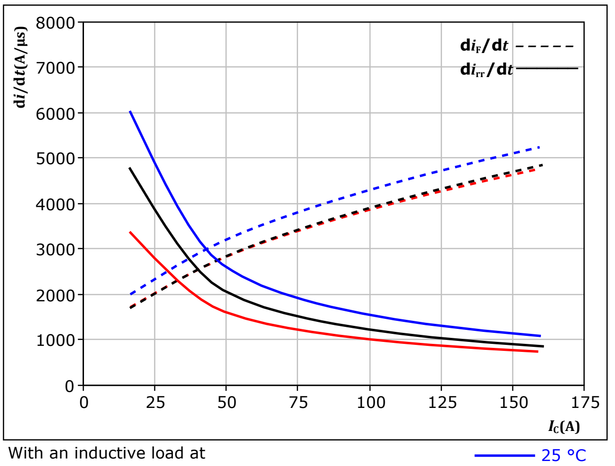
T_j: 25 °C, 125 °C, 150 °C

Buck 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)



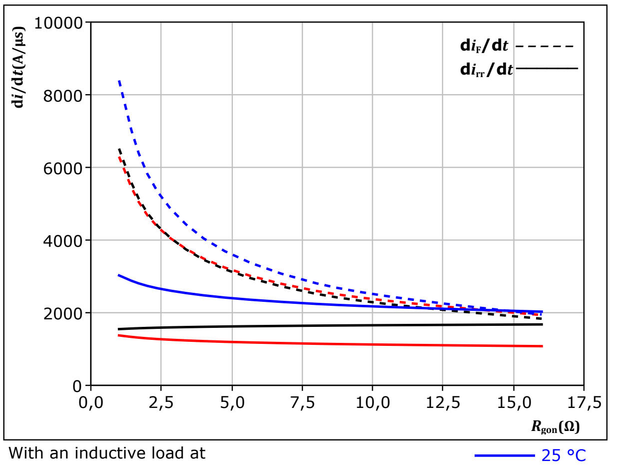
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
R_{gon} =	4	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})



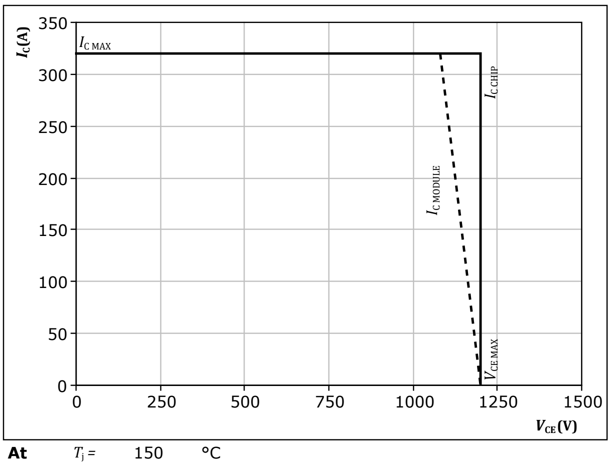
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	±15	V		125 °C
I_C =	80	A		150 °C

figure 35. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



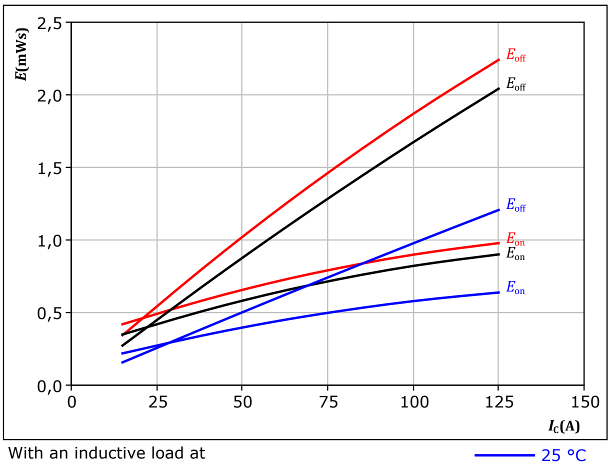
At	T_j =	150	°C
	R_{gon} =	4	Ω
	R_{goff} =	4	Ω

Boost Switching Characteristics

figure 36. **IGBT**

Typical switching energy losses as a function of collector current

$E = f(I_C)$



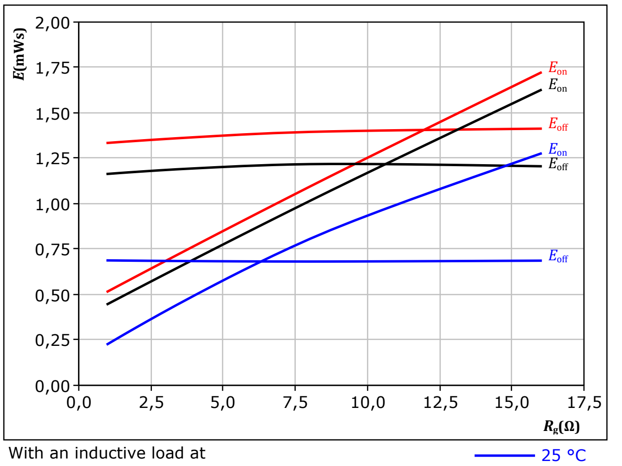
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	-5/15	V		125 °C
R_{gon} =	4	Ω		150 °C
R_{goff} =	4	Ω		

figure 37. **IGBT**

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

$E = f(R_g)$



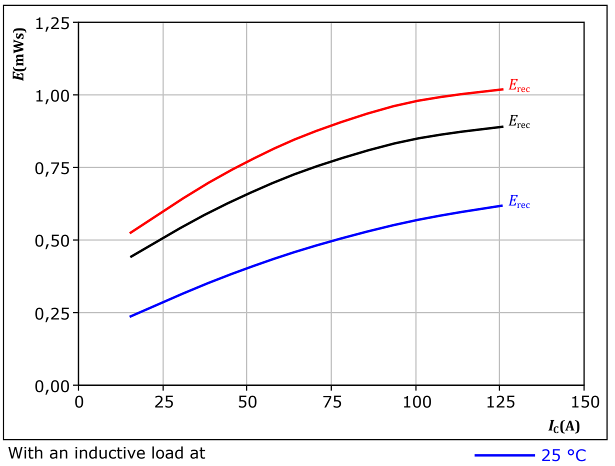
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	-5/15	V		125 °C
I_C =	70	A		150 °C

figure 38. **FWD**

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



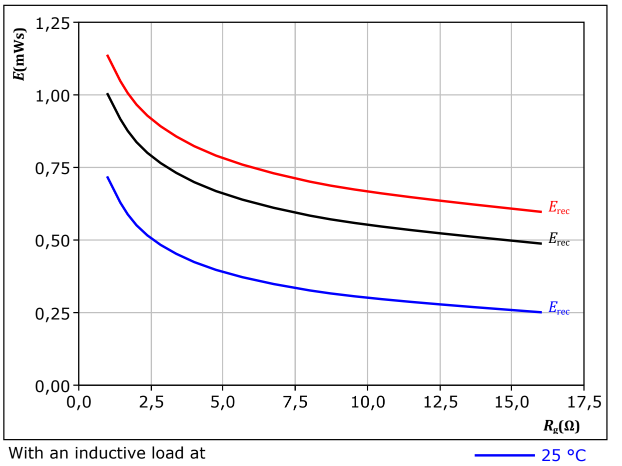
With an inductive load at

V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	-5/15	V		125 °C
R_{gon} =	4	Ω		150 °C

figure 39. **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

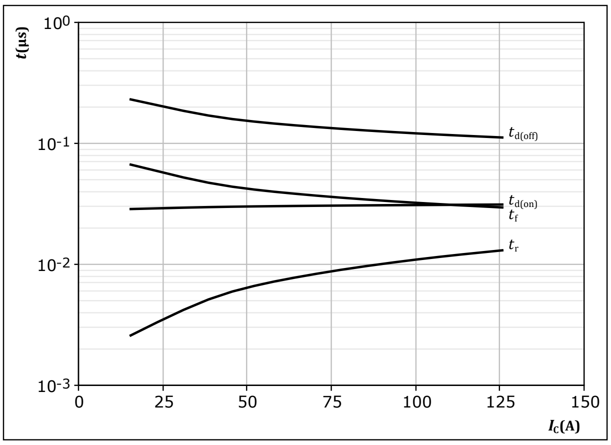
V_{CE} =	350	V	T_j:	25 °C
V_{GE} =	-5/15	V		125 °C
I_C =	70	A		150 °C

Boost Switching Characteristics

figure 40. **IGBT**

Typical switching times as a function of collector current

t = f(I_C)



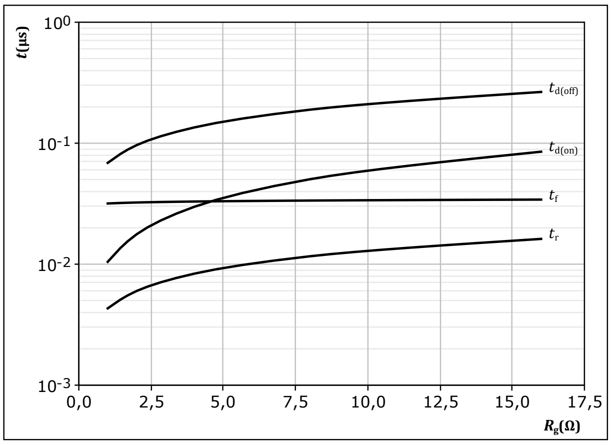
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	-5/15	V
R_{gon} =	4	Ω
R_{goff} =	4	Ω

figure 41. **IGBT**

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

t = f(R_g)



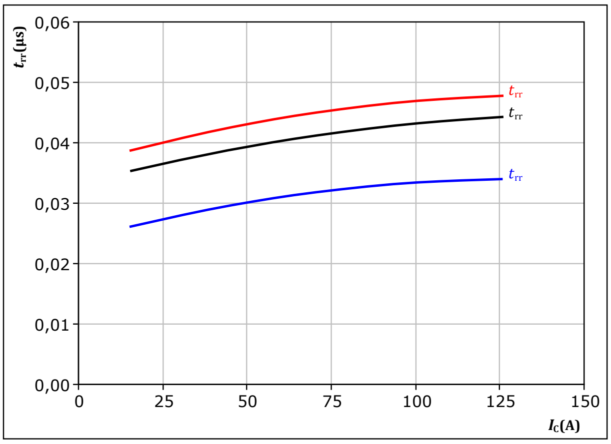
With an inductive load at

T_j =	150	°C
V_{CE} =	350	V
V_{GE} =	-5/15	V
I_C =	70	A

figure 42. **FWD**

Typical reverse recovery time as a function of collector current

t_{rr} = f(I_C)



With an inductive load at

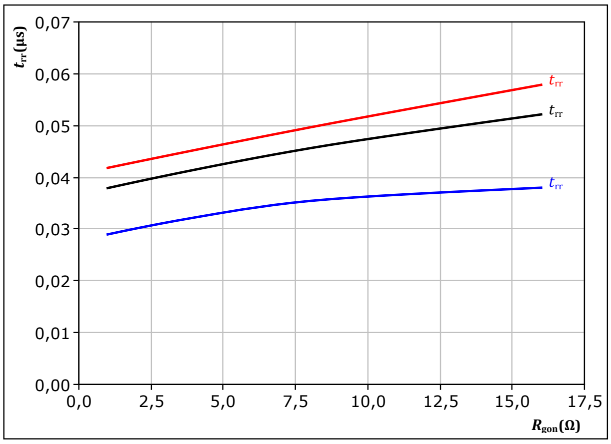
V_{CE} =	350	V
V_{GE} =	-5/15	V
R_{gon} =	4	Ω

T_j: 25 °C, 125 °C, 150 °C

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} =	350	V
V_{GE} =	-5/15	V
I_C =	70	A

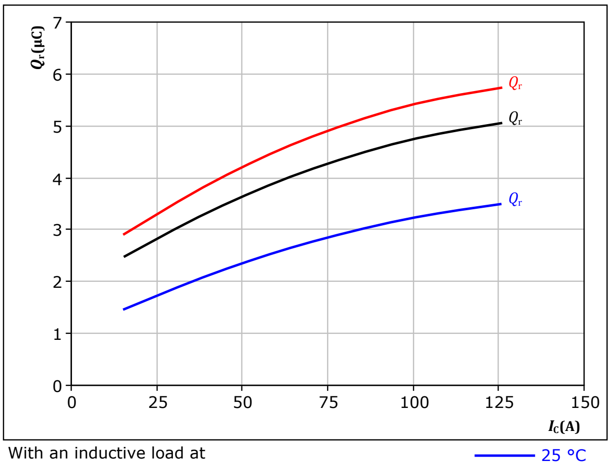
T_j: 25 °C, 125 °C, 150 °C

Boost Switching Characteristics

figure 44. FWD

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$



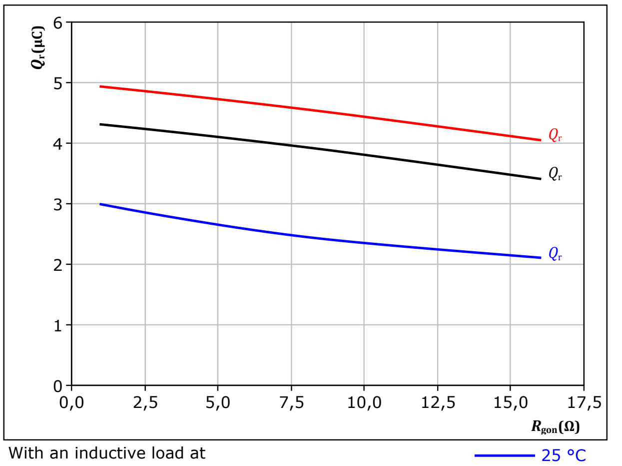
With an inductive load at

V_{CE} =	350	V	T_j: 25 °C / 125 °C / 150 °C
V_{GE} =	-5/15	V	
R_{gon} =	4	Ω	

figure 45. FWD

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

$Q_r = f(R_{gon})$



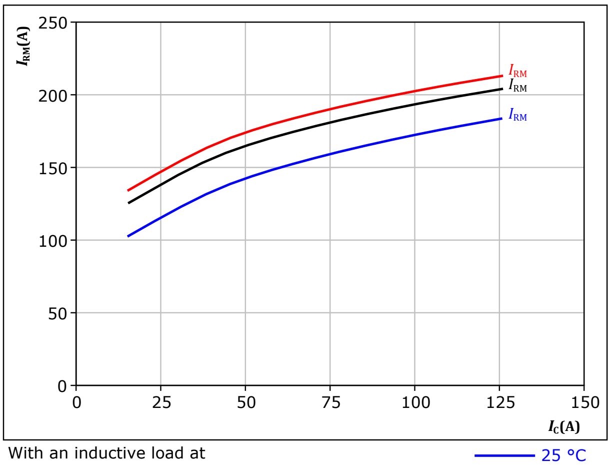
With an inductive load at

V_{CE} =	350	V	T_j: 25 °C / 125 °C / 150 °C
V_{GE} =	-5/15	V	
I_C =	70	A	

figure 46. FWD

Typical peak reverse recovery current as a function of collector current

$I_{RM} = f(I_C)$



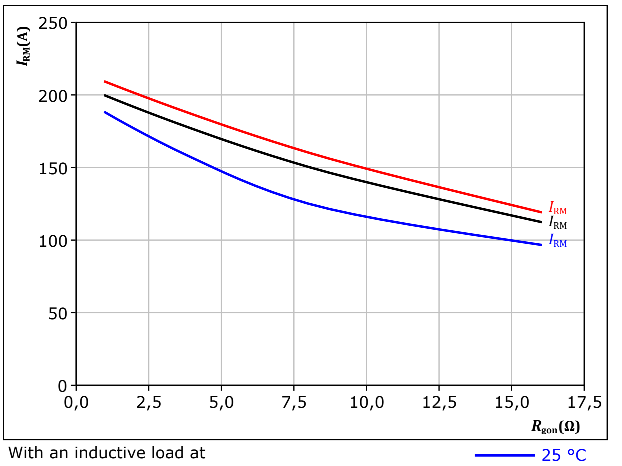
With an inductive load at

V_{CE} =	350	V	T_j: 25 °C / 125 °C / 150 °C
V_{GE} =	-5/15	V	
R_{gon} =	4	Ω	

figure 47. 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

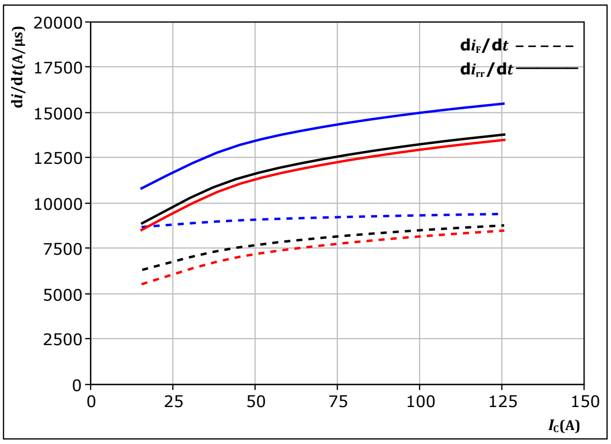
V_{CE} =	350	V	T_j: 25 °C / 125 °C / 150 °C
V_{GE} =	-5/15	V	
I_C =	70	A	

Boost 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)



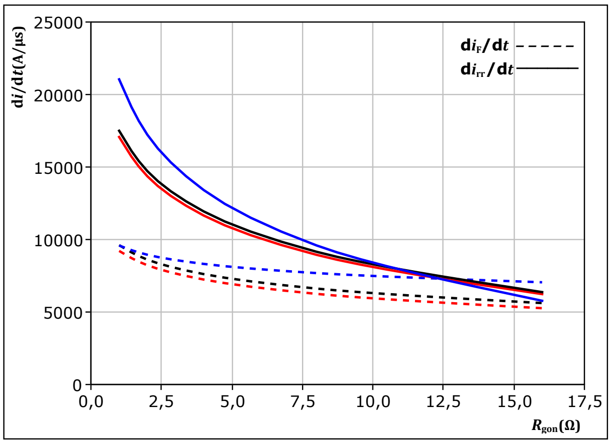
With an inductive load at

V_{CE} =	350	V	T_j: 25 °C
V_{GE} =	-5/15	V	125 °C
R_{gon} =	4	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})



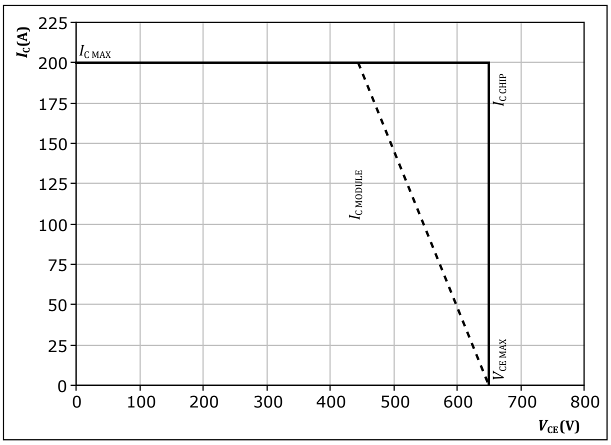
With an inductive load at

V_{CE} =	350	V	T_j: 25 °C
V_{GE} =	-5/15	V	125 °C
I_C =	70	A	150 °C

figure 50. **IGBT**

Reverse bias safe operating area

I_C = f(V_{CE})



At	T_j =	150	°C
	R_{gon} =	4	Ω
	R_{goff} =	4	Ω

Switching Definitions

figure 51. **IGBT**

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

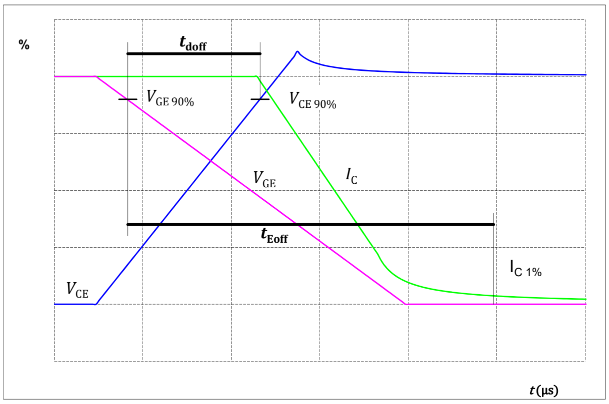


figure 52. **IGBT**

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

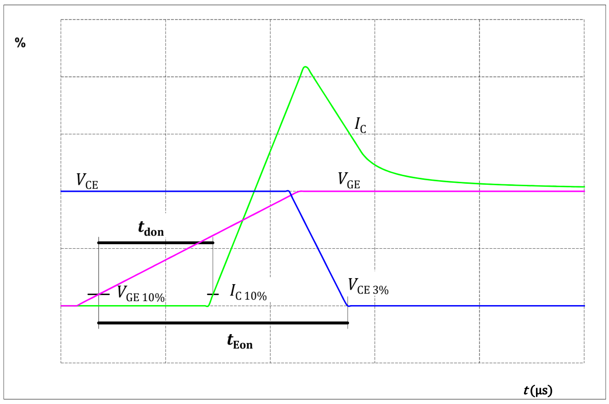


figure 53. **IGBT**

Turn-off Switching Waveforms & definition of t_f

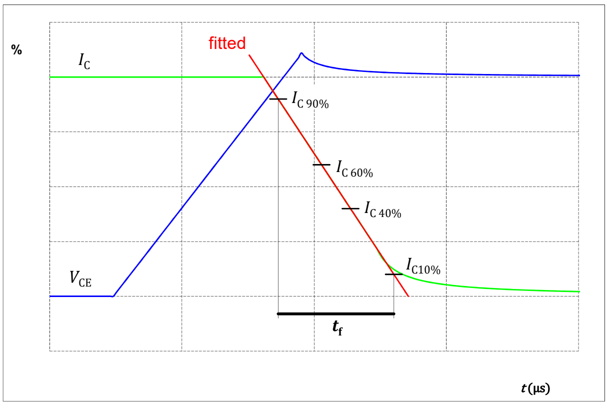
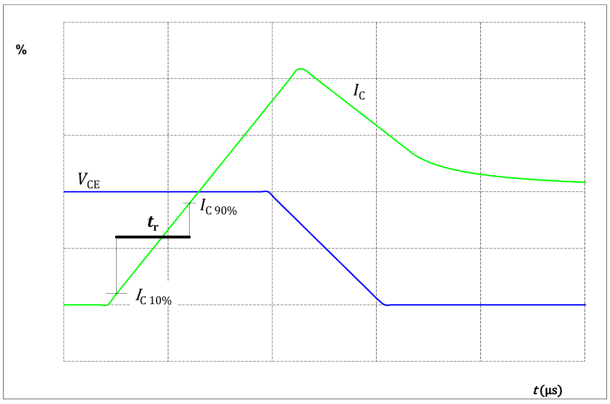


figure 54. **IGBT**

Turn-on Switching Waveforms & definition of t_r



Switching Definitions

figure 55.	**FWD**

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

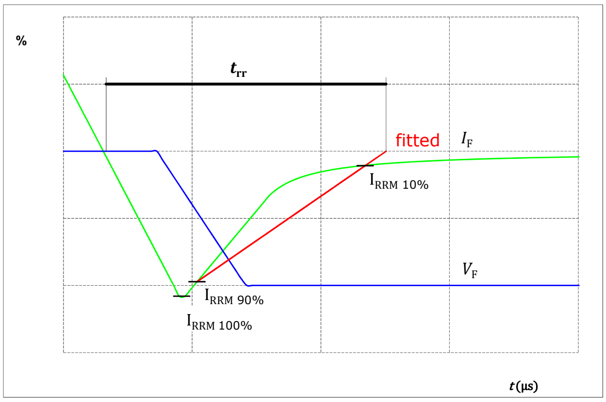
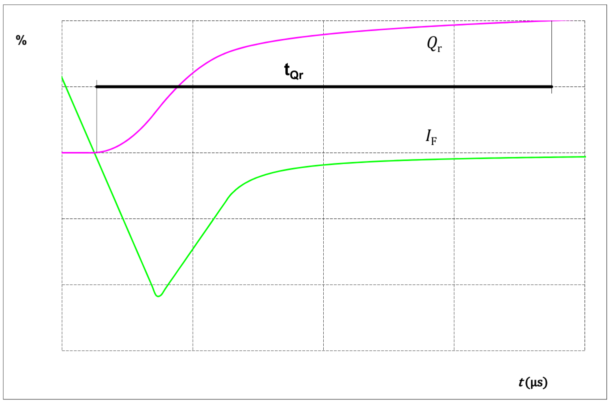


figure 56.	**FWD**

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



30-FT12NMA160SH02-M669F28
datasheet

Ordering Code

Version	Ordering Code
Without thermal paste	30-FT12NMA160SH02-M669F28
With thermal paste (3,4 W/mK, PSX-P7)	30-FT12NMA160SH02-M669F28-/3/

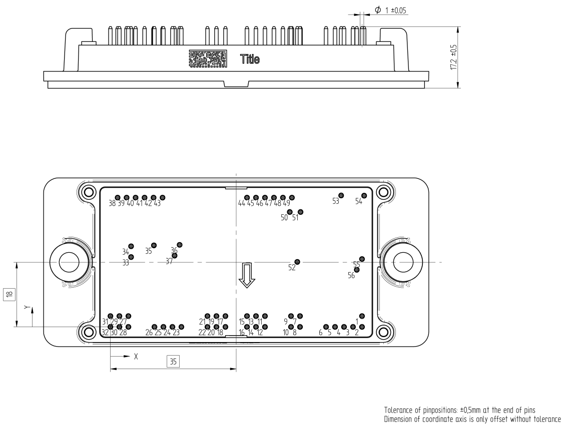
Marking

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

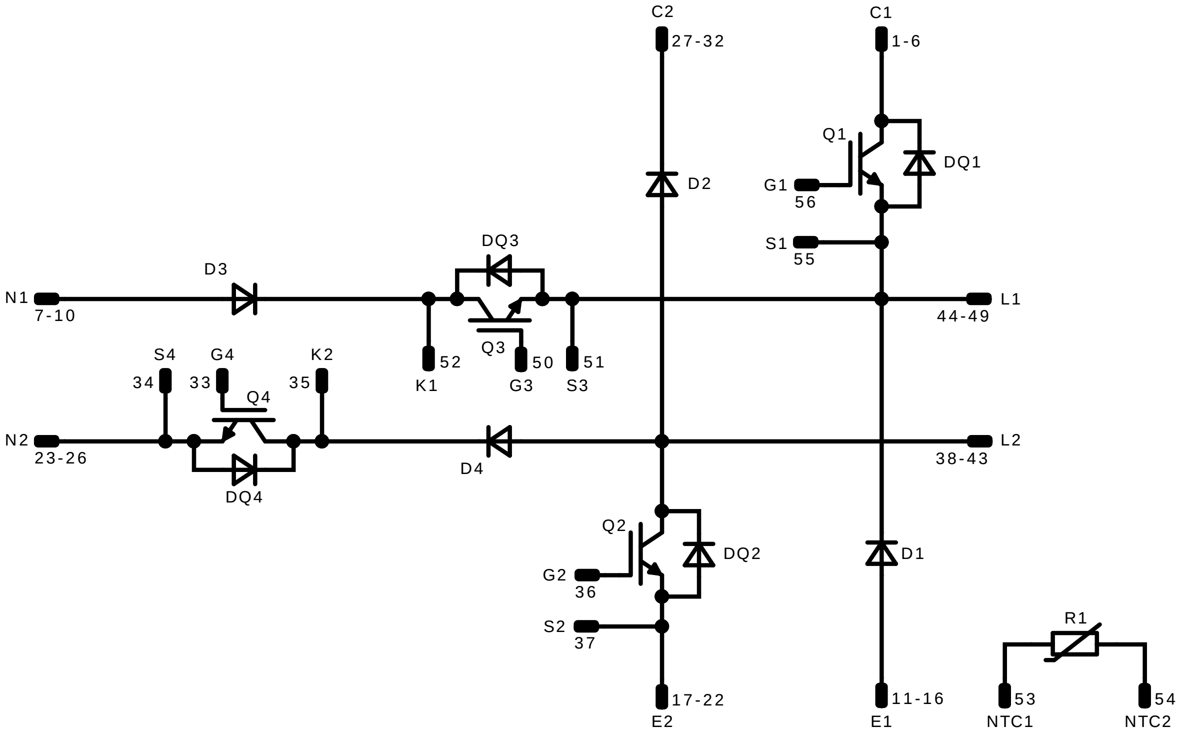
Outline

Pin table [mm]

Pin	X	Y	Function	29	2,5	3	C2
1	70	3	C1	30	2,5	0	C2
2	70	0	C1	31	0	3	C2
3	67,5	0	C1	32	0	0	C2
4	65	0	C1	33	5,75	19,45	G4
5	62,5	0	C1	34	5,75	22,45	S4
6	60	0	C1	35	12,1	22,7	K2
7	52,75	3	N1	36	19,25	22,85	G2
8	52,75	0	N1	37	17,85	19,85	S2
9	50,25	3	N1	38	2	36	L2
10	50,25	0	N1	39	4,5	36	L2
11	43	3	E1	40	7	36	L2
12	43	0	E1	41	9,5	36	L2
13	40,5	3	E1	42	12	36	L2
14	40,5	0	E1	43	14,5	36	L2
15	38	3	E1	44	38	36	L1
16	38	0	E1	45	40,5	36	L1
17	32	3	E2	46	43	36	L1
18	32	0	E2	47	45,5	36	L1
19	29,5	3	E2	48	48	36	L1
20	29,5	0	E2	49	50,5	36	L1
21	27	3	E2	50	49,9	32	G3
22	27	0	E2	51	52,9	32	S3
23	19,75	0	N2	52	52	18,1	K1
24	17,25	0	N2	53	64,2	36,6	NTC
25	14,75	0	N2	54	70,6	36,55	NTC
26	12,25	0	N2	55	70	18,9	S1
27	5	3	C2	56	68,55	15,9	G1
28	5	0	C2				



Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
Q1, Q2	IGBT	1200 V	160 A	Buck Switch	
D3, D4	FWD	650 V	150 A	Buck Diode	
DQ1, DQ2	FWD	1200 V	10 A	Buck Sw. Protection Diode	
Q4, Q3	IGBT	650 V	100 A	Boost Switch	
D2, D1	FWD	1200 V	70 A	Boost Diode	
DQ4, DQ3	FWD	650 V	30 A	Boost Sw. Protection Diode	
NTC	NTC			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 36	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 2 packages see vincotech.com website.

Package data
Package data for *flow* 2 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 $T_{j,op}$=175°C and up to 3500VAC/1min isolation voltage. For more information see vincotech.com website.

Document No.:	**Date:**	**Modification:**	**Pages**
30-FT12NMA160SH02-M669F28-D7-14	21 Nov. 2024	Change Boost Switch/Diode, and Buck Diode/Sw. Protection Diode (PCN-41-2023)	