



Vincotech

# 30-FT10NIA400S702-LP59F04

datasheet

flowNPC 2

950 V / 400 A

## Topology features

- Low side Kelvin Emitter for improved switching performance
- Neutral Point Clamped Topology (I-Type)
- Split topology
- Temperature sensor

## Component features

- Low collector emitter saturation voltage
- High speed and smooth switching

## Housing features

- Base isolation:  $\text{Si}_3\text{N}_4$
- Convex shaped baseplate for superior thermal contact
- Cu baseplate
- Thermo-mechanical push-and-pull force relief
- Solder pin

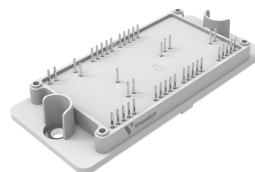
## Target applications

- Solar Inverters

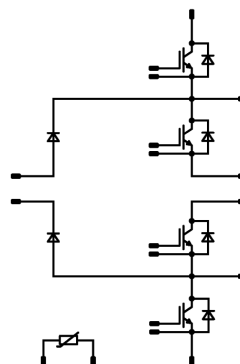
## Types

- 30-FT10NIA400S702-LP59F04

## flow 2 13 mm housing



## Schematic





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## Maximum Ratings

$T_j = 25\text{ °C}$ , unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
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### Buck Switch

Collector-emitter voltage	$V_{CES}$		950	V
Collector current (DC current)	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	315	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	800	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	595	W
Gate-emitter voltage	$V_{GES}$		$\pm 20$	V
Maximum junction temperature	$T_{jmax}$		175	°C

### Buck Diode

Peak repetitive reverse voltage	$V_{RRM}$		1200	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	135	A
Surge (non-repetitive) forward current	$I_{FSM}$	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	715	A
Surge current capability	$I^2t$		2550	A <sup>2</sup> s
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	305	W
Maximum junction temperature	$T_{jmax}$		175	°C

### Boost Switch

Collector-emitter voltage	$V_{CES}$		950	V
Collector current (DC current)	$I_C$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	388	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{jmax}$	800	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	483	W
Gate-emitter voltage	$V_{GES}$		$\pm 20$	V
Maximum junction temperature	$T_{jmax}$		175	°C



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## Maximum Ratings

$T_j = 25\text{ °C}$ , unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
<b>Boost Diode</b>				
Peak repetitive reverse voltage	$V_{RRM}$		950	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	131	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	400	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	253	W
Maximum junction temperature	$T_{jmax}$		175	°C

## Boost Sw. Inv. Diode

Peak repetitive reverse voltage	$V_{RRM}$		950	V
Forward current (DC current)	$I_F$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	131	A
Repetitive peak forward current	$I_{FRM}$	$t_p$ limited by $T_{jmax}$	400	A
Total power dissipation	$P_{tot}$	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	253	W
Maximum junction temperature	$T_{jmax}$		175	°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* $t_p = 2\text{ s}$	6000	V
Creepage distance			>12,7	mm
Clearance			>12,7	mm
Comparative Tracking Index	CTI		≥ 600	

\*100 % tested in production



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## 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 Switch

### Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,00668	25	4,35	5,1	5,85	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		400	25 125 150		1,67 1,94 2,01	2,35 <sup>(1)</sup>	V
Collector-emitter cut-off current	$I_{CES}$		0	950		25			8	µA
Gate-emitter leakage current	$I_{GES}$		20	0		25			400	nA
Internal gate resistance	$r_g$							0,375		Ω
Input capacitance	$C_{ies}$	$f = 100 \text{ kHz}$	0	25		25		26000		pF
Output capacitance	$C_{oes}$							556		pF
Reverse transfer capacitance	$C_{res}$							80		pF
Gate charge	$Q_g$		±15		0	25		920		nC

### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						0,16		K/W
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### Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 2 \text{ } \Omega$ $R_{goff} = 2 \text{ } \Omega$	±15	600	400	25 125 150		139,85 141,27 141,53		ns
Rise time	$t_r$					25 125 150		27,94 29,79 30,14		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		122,56 146,8 153,43		ns
Fall time	$t_f$					25 125 150		27,45 45,51 51,93		ns
Turn-on energy (per pulse)	$E_{on}$	$Q_{tFWD}=0,975 \text{ } \mu\text{C}$ $Q_{tFWD}=1,01 \text{ } \mu\text{C}$ $Q_{tFWD}=1,07 \text{ } \mu\text{C}$				25 125 150		9,42 9,56 9,69		mWs
Turn-off energy (per pulse)	$E_{off}$					25 125 150		10,38 17,96 20,25		mWs





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## 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	$V_F$				100	25 125 150		1,44 1,71 1,81	1,6 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_r = 1200$ V				25 150		1 70	400	µA

### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,31		K/W
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### Dynamic

Peak recovery current	$I_{RM}$	$di/dt=8622$ A/µs $di/dt=9063$ A/µs $di/dt=9748$ A/µs	$\pm 15$	600	400	25 125 150		89,49 92,42 93,12		A
Reverse recovery time	$t_{rr}$					25 125 150		18,47 18,7 19,91		ns
Recovered charge	$Q_r$					25 125 150		0,975 1,01 1,07		µC
Reverse recovered energy	$E_{rec}$					25 125 150		0,2 0,215 0,234		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125 150		13105,2 13542,13 14636,48		A/µs



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## Characteristic Values

Parameter	Symbol	Conditions					Values			Unit
			$V_{GE}$ [V] $V_{GS}$ [V]	$V_{CE}$ [V] $V_{DS}$ [V] $V_F$ [V]	$I_C$ [A] $I_D$ [A] $I_F$ [A]	$T_j$ [°C]	Min	Typ	Max	

### Boost Switch

#### Static

Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0065	25	4,15	4,85	5,65	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		400	25 125 150		1,21 1,23 1,24	1,4 <sup>(1)</sup>	V
Collector-emitter cut-off current	$I_{CES}$		0	950		25			8	µA
Gate-emitter leakage current	$I_{GES}$		20	0		25			200	nA
Internal gate resistance	$r_g$							0,75		Ω
Input capacitance	$C_{ies}$	$f = 100 \text{ kHz}$	0	25		25		49200		pF
Output capacitance	$C_{oes}$							530		pF
Reverse transfer capacitance	$C_{res}$							220		pF
Gate charge	$Q_g$		±15		0	25		4100		nC

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4 \text{ W/mK}$ (PSX)						0,2		K/W
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#### Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 2 \Omega$ $R_{goff} = 2 \Omega$	±15	600	400	25 125 150		350,79 357,58 359,52		ns
Rise time	$t_r$					25 125 150		33,96 37,07 38,17		ns
Turn-off delay time	$t_{d(off)}$					25 125 150		323,89 373,74 386,34		ns
Fall time	$t_f$					25 125 150		263,26 364,29 383,57		ns
Turn-on energy (per pulse)	$E_{on}$					25 125 150		8,2 10,02 10,86		mWs
Turn-off energy (per pulse)	$E_{off}$	$Q_{tFWD} = 6,17 \mu\text{C}$ $Q_{tFWD} = 15,31 \mu\text{C}$ $Q_{tFWD} = 18,06 \mu\text{C}$				25 125 150		50,11 71,74 76,66		mWs



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## 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	$V_F$				200	25 125 150	2,1	2,64 2,44 2,36	2,8 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_r = 950$ V				25			8	µA

#### Thermal

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,38		K/W
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#### Dynamic

Peak recovery current	$I_{RM}$	$di/dt=10226$ A/µs $di/dt=9659$ A/µs $di/dt=9779$ A/µs	$\pm 15$	600	400	25 125 150		209,43 261,92 279,24		A
Reverse recovery time	$t_{rr}$					25 125 150		56,49 164,87 182,42		ns
Recovered charge	$Q_r$					25 125 150		6,17 15,31 18,06		µC
Reverse recovered energy	$E_{rec}$					25 125 150		2,5 6,62 7,85		mWs
Peak rate of fall of recovery current	$(di_{rr}/dt)_{max}$					25 125 150		7421,55 7019,14 6599,04		A/µs



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datasheet

**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. Inv. Diode**

**Static**

Forward voltage	$V_F$				200	25 125 150	2,1	2,64 2,44 2,36	2,8 <sup>(1)</sup>	V
Reverse leakage current	$I_R$	$V_i = 950$ V				25			8	µA

**Thermal**

Thermal resistance junction to sink <sup>(2)</sup>	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,38		K/W
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**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	

<sup>(1)</sup> Value at chip level

<sup>(2)</sup> Only valid with pre-applied Vincotech thermal interface material.



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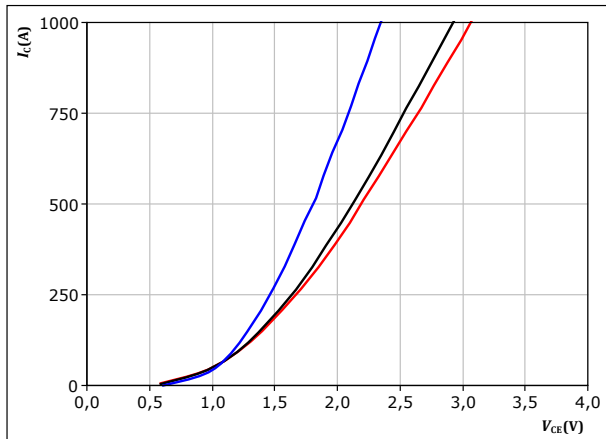
# 30-FT10NIA400S702-LP59F04 datasheet

## Buck Switch Characteristics

figure 1. IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$

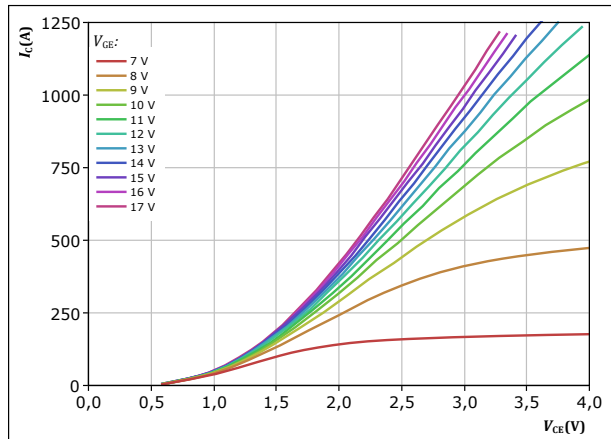


$t_p = 250 \mu s$   
 $V_{GE} = 15 V$   
 $T_j:$  25 °C, 125 °C, 150 °C

figure 2. IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$

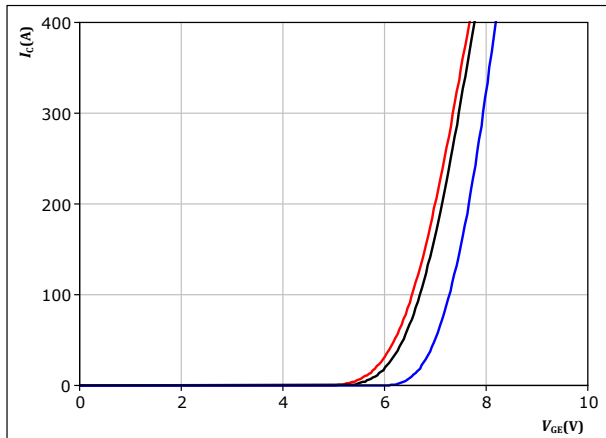


$t_p = 250 \mu s$   
 $T_j = 150 ^\circ C$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

$$I_C = f(V_{GE})$$

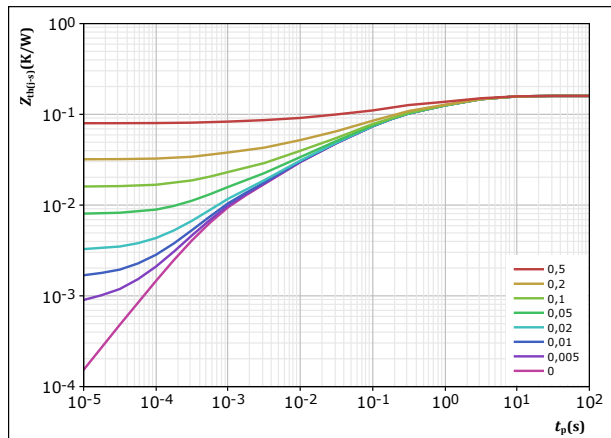


$t_p = 250 \mu s$   
 $V_{CE} = 10 V$   
 $T_j:$  25 °C, 125 °C, 150 °C

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,16 K/W$   
IGBT thermal model values  

$R (K/W)$	$\tau (s)$
2,78E-02	3,63E+00
4,33E-02	8,40E-01
5,78E-02	9,61E-02
2,24E-02	8,88E-03
8,34E-03	6,81E-04



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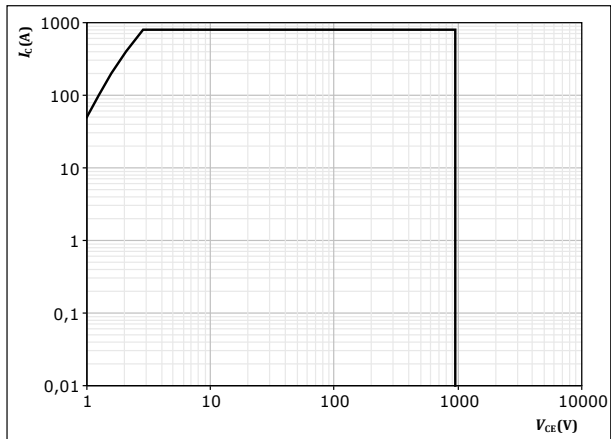
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datasheet

## Buck Switch Characteristics

**figure 5.** IGBT

Safe operating area

$$I_C = f(V_{CE})$$



$D = \text{single pulse}$

$T_s = 80 \text{ } ^\circ\text{C}$   
 $V_{GE} = 15 \text{ V}$   
 $T_j = T_{jmax}$



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## Buck Diode Characteristics

figure 6.

FWD

Typical forward characteristics

$$I_F = f(V_F)$$

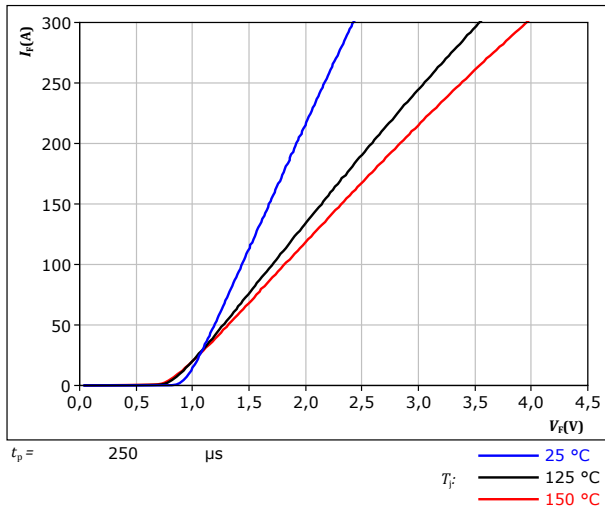
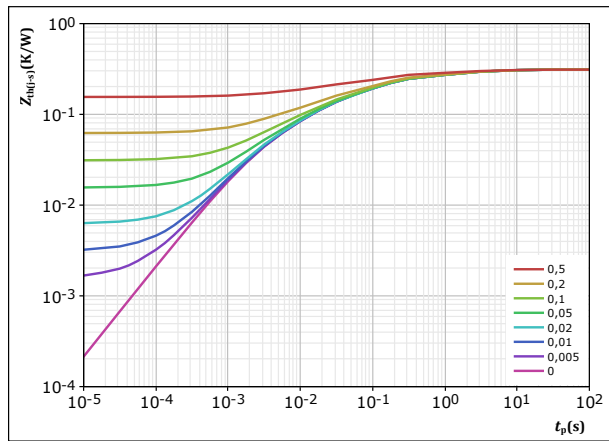


figure 7.

FWD

Transient thermal impedance as a function of pulse width

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



$D =$	$t_p / T$	
$R_{th(j-s)} =$	0,311	K/W
FWD thermal model values		
$R$ (K/W)	$\tau$ (s)	
1,70E-02	6,92E+00	
5,16E-02	1,30E+00	
1,30E-01	1,14E-01	
8,31E-02	1,37E-02	
3,01E-02	2,13E-03	



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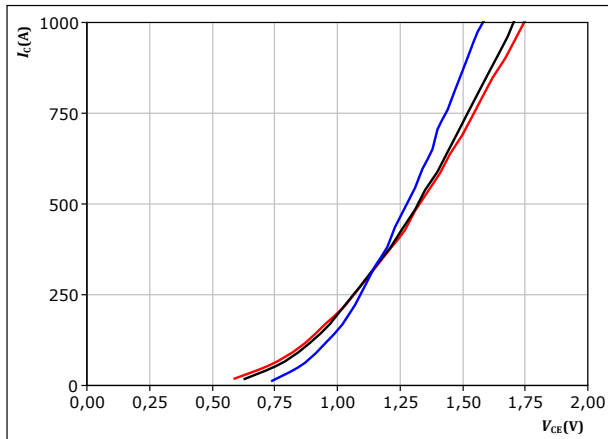
### Boost Switch Characteristics

figure 8.

IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$



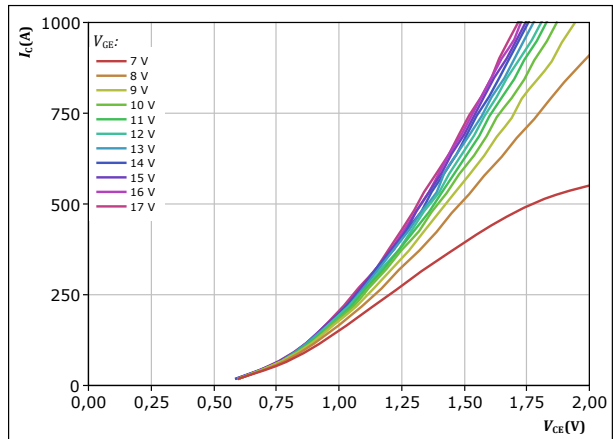
$t_p = 250 \mu s$   
 $V_{GE} = 15 V$   
 $T_j:$  25 °C, 125 °C, 150 °C

figure 9.

IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$



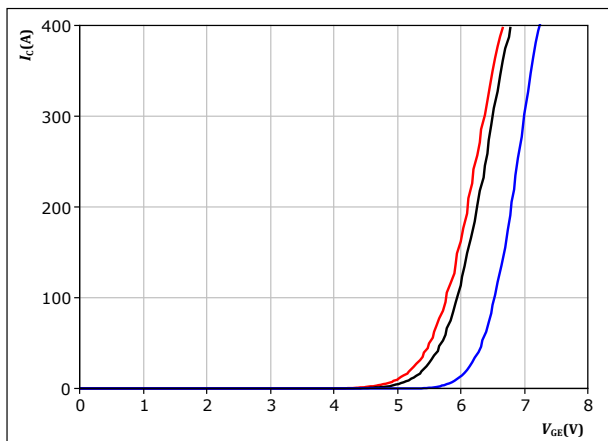
$t_p = 250 \mu s$   
 $T_j = 150 ^\circ C$   
 $V_{GE}$  from 7 V to 17 V in steps of 1 V

figure 10.

IGBT

Typical transfer characteristics

$$I_C = f(V_{GE})$$



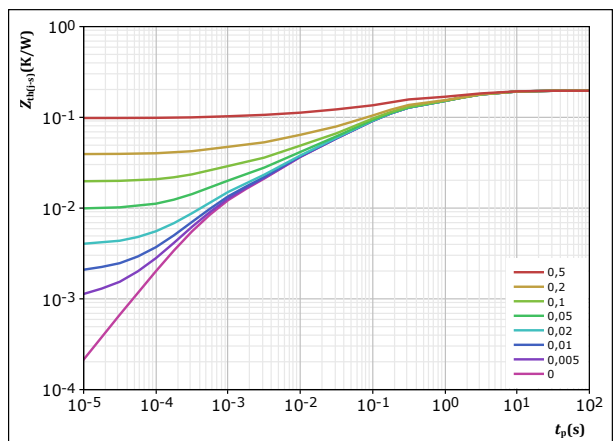
$t_p = 250 \mu s$   
 $V_{CE} = 10 V$   
 $T_j:$  25 °C, 125 °C, 150 °C

figure 11.

IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$   
 $R_{th(j-s)} = 0,196 K/W$   
IGBT thermal model values  

R (K/W)	$\tau$ (s)
1,70E-02	6,58E+00
5,92E-02	1,50E+00
8,39E-02	1,08E-01
2,62E-02	8,19E-03
1,02E-02	5,83E-04





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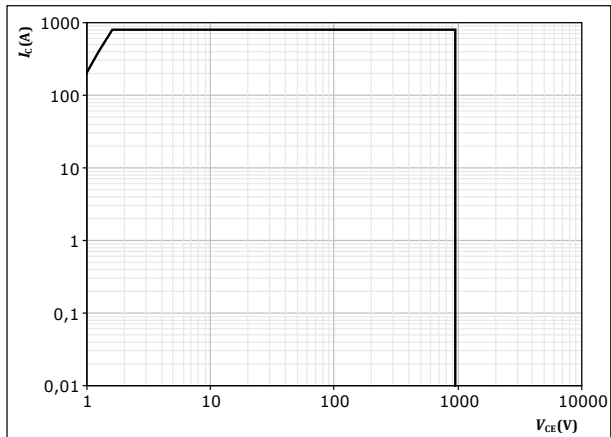
## Boost Switch Characteristics

figure 12.

IGBT

Safe operating area

$I_C = f(V_{CE})$



$D = \text{single pulse}$

$T_s = 80 \text{ } ^\circ\text{C}$   
 $V_{GE} = 15 \text{ V}$   
 $T_j = T_{jmax}$



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## Boost Diode Characteristics

figure 13.

FWD

Typical forward characteristics

$$I_F = f(V_F)$$

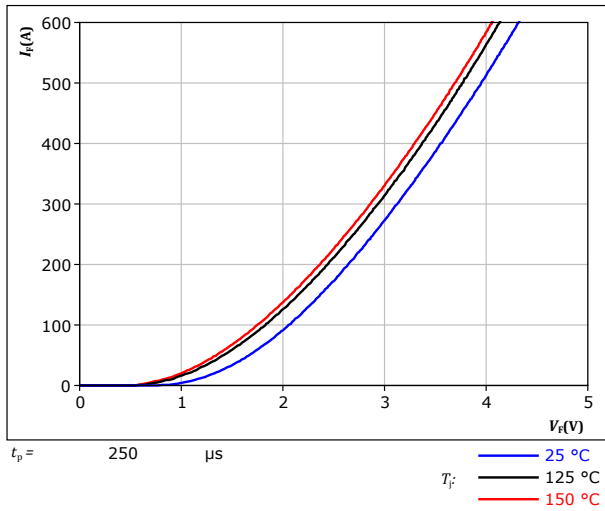
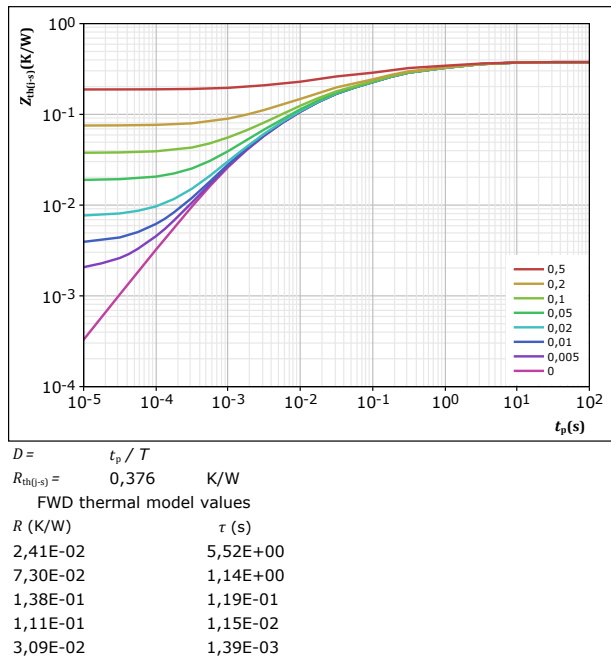


figure 14.

FWD

Transient thermal impedance as a function of pulse width

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





Boost Sw. Inv. Diode Characteristics

figure 15. FWD

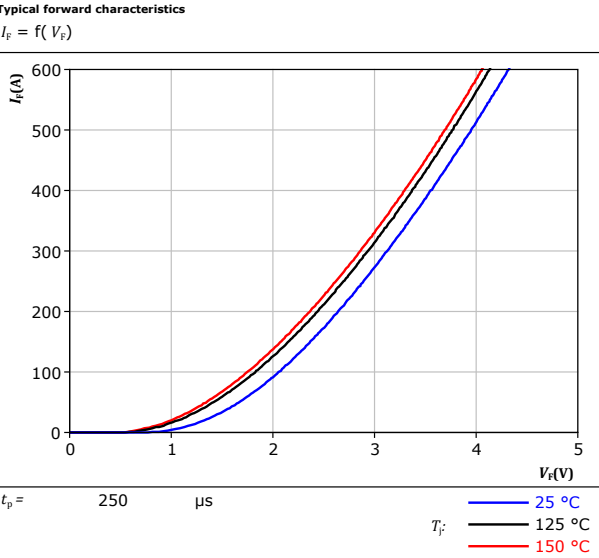
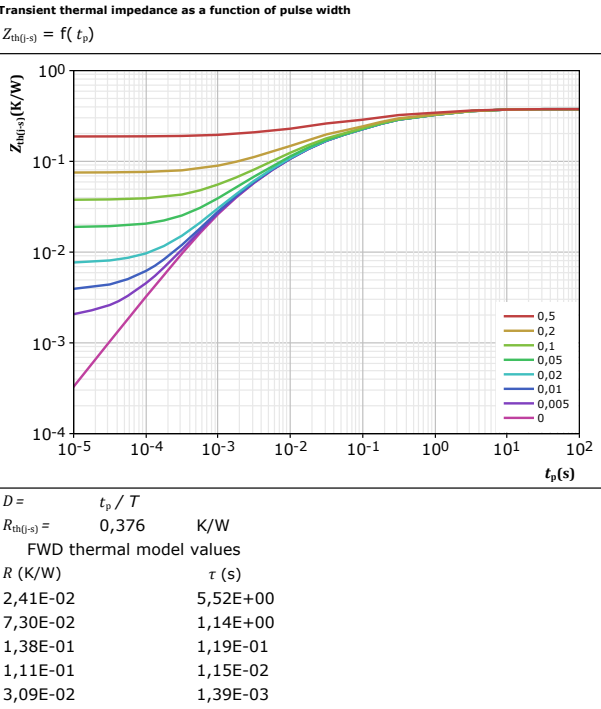


figure 16. FWD





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## Thermistor Characteristics

figure 17.

Thermistor

Typical NTC characteristic as function of temperature

$$R_T = f(T)$$





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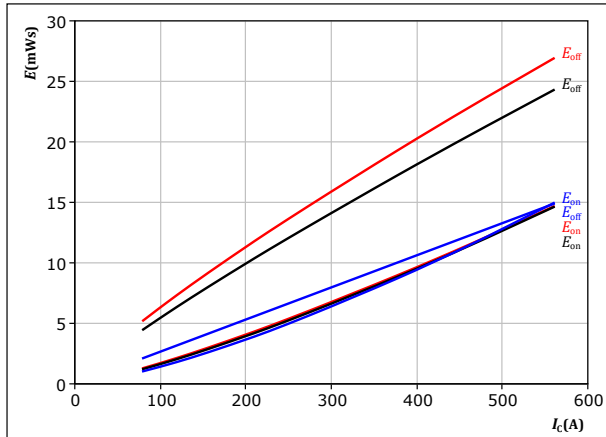
## Buck Switching Characteristics

figure 18.

IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_C)$$



With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 2 \text{ } \Omega$   
 $R_{goff} = 2 \text{ } \Omega$

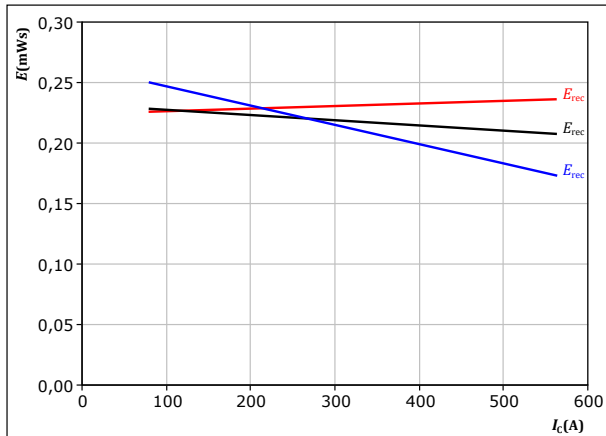
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 20.

FWD

Typical reverse recovered energy loss as a function of collector current

$$E_{rec} = f(I_C)$$



With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 2 \text{ } \Omega$

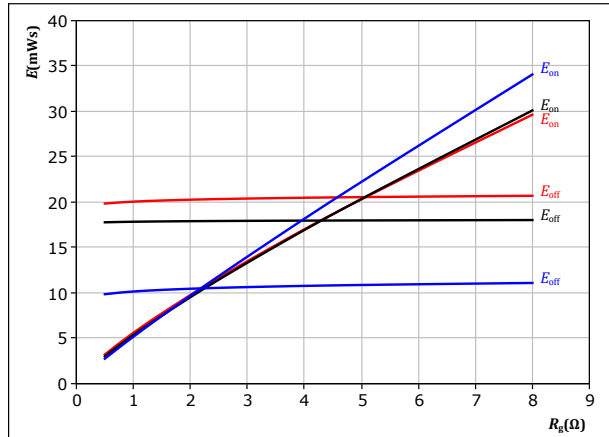
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 19.

IGBT

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

$$E = f(R_g)$$



With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_C = 400 \text{ A}$

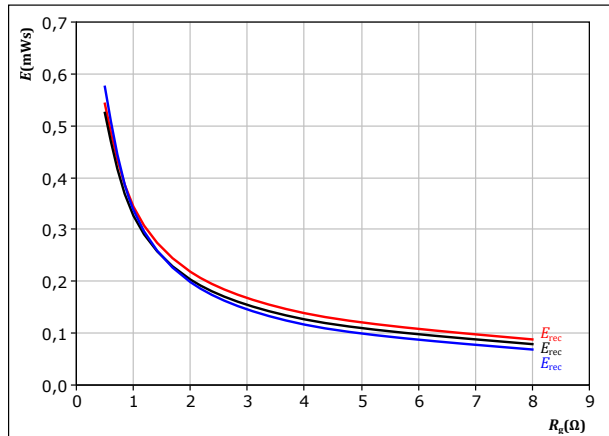
$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C

figure 21.

FWD

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

$$E_{rec} = f(R_g)$$



With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_C = 400 \text{ A}$

$T_j$ :  
— 25 °C  
— 125 °C  
— 150 °C



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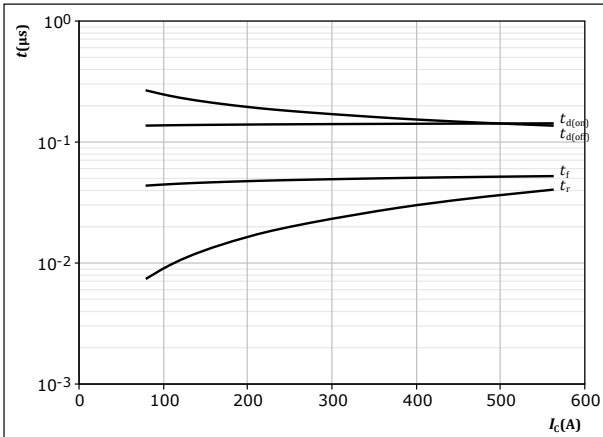
30-FT10NIA400S702-LP59F04  
datasheet

## Buck Switching Characteristics

figure 22.

IGBT

Typical switching times as a function of collector current  
 $t = f(I_C)$



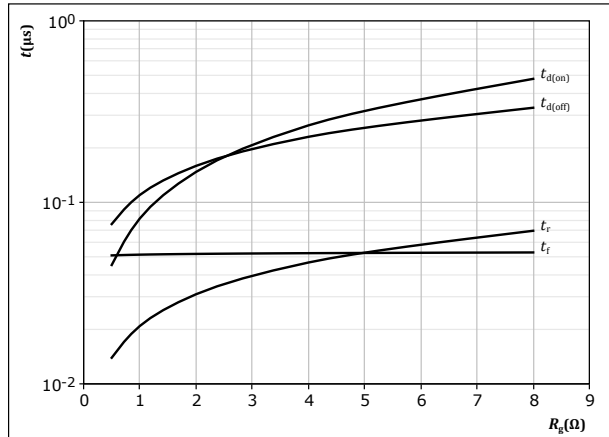
With an inductive load at

$T_j = 150$  °C  
 $V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 2$   $\Omega$   
 $R_{goff} = 2$   $\Omega$

figure 23.

IGBT

Typical switching times as a function of IGBT turn on gate resistor  
 $t = f(R_g)$



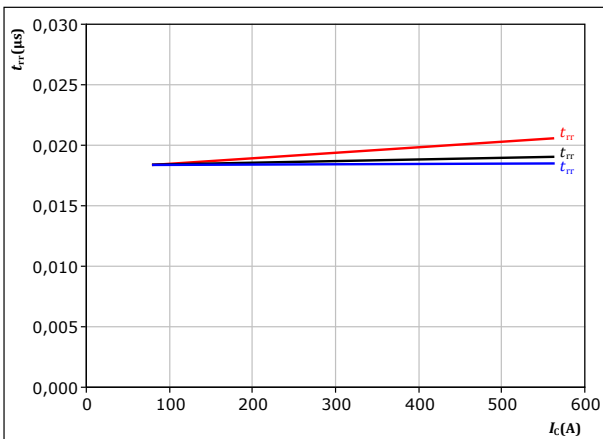
With an inductive load at

$T_j = 150$  °C  
 $V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_C = 400$  A

figure 24.

FWD

Typical reverse recovery time as a function of collector current  
 $t_{rr} = f(I_C)$



With an inductive load at

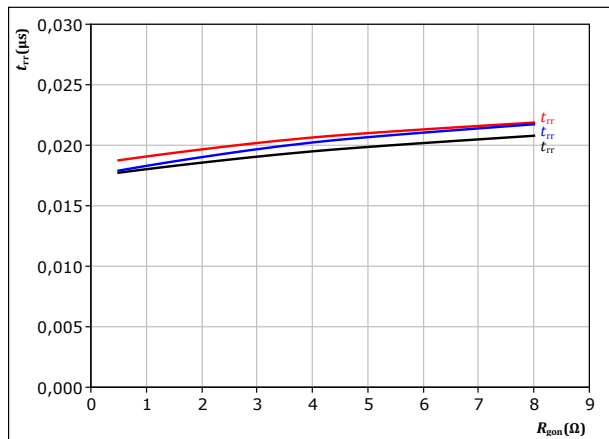
$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 2$   $\Omega$

$T_j$ : 25 °C  
125 °C  
150 °C

figure 25.

FWD

Typical reverse recovery time as a function of IGBT turn on gate resistor  
 $t_{rr} = f(R_{gon})$



With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_C = 400$  A

$T_j$ : 25 °C  
125 °C  
150 °C



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datasheet

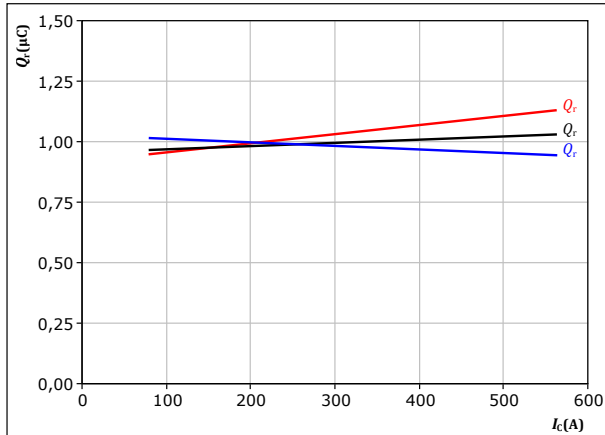
## Buck Switching Characteristics

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  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 2$  Ω

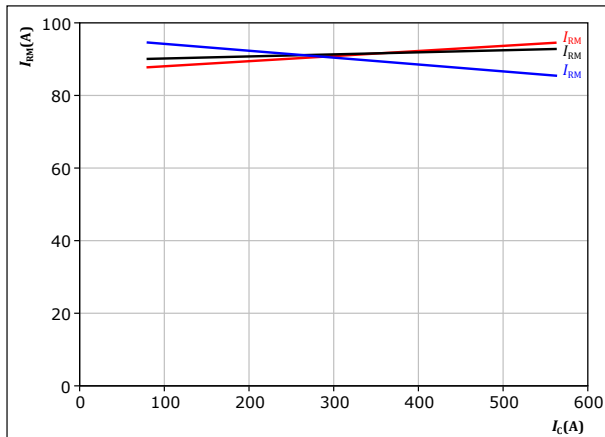
$T_j$ : 25 °C  
125 °C  
150 °C

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  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 2$  Ω

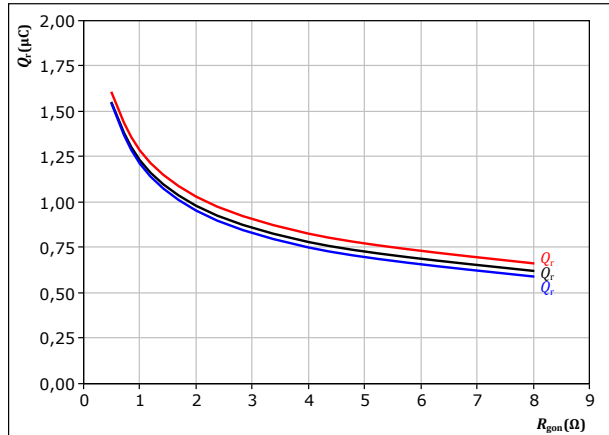
$T_j$ : 25 °C  
125 °C  
150 °C

figure 27.

FWD

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

$$Q_r = f(R_{gon})$$



With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 400$  A

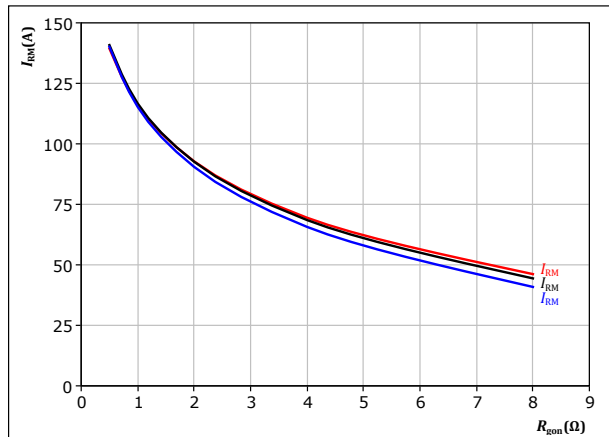
$T_j$ : 25 °C  
125 °C  
150 °C

figure 29.

FWD

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

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



With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 400$  A

$T_j$ : 25 °C  
125 °C  
150 °C



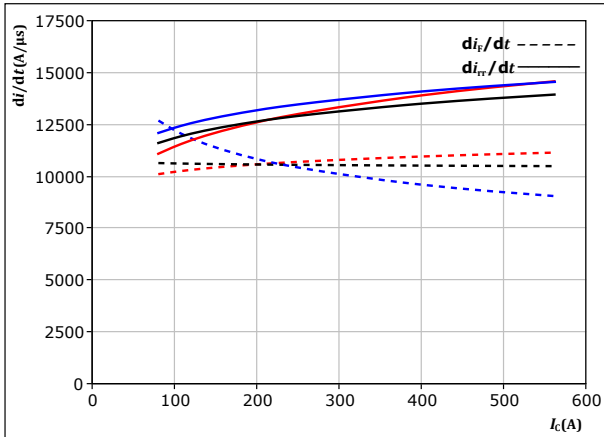
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datasheet

## Buck Switching Characteristics

**figure 30.** FWD

Typical rate of fall of forward and reverse recovery current as a function of collector current  
 $di_f/dt, di_r/dt = f(I_C)$



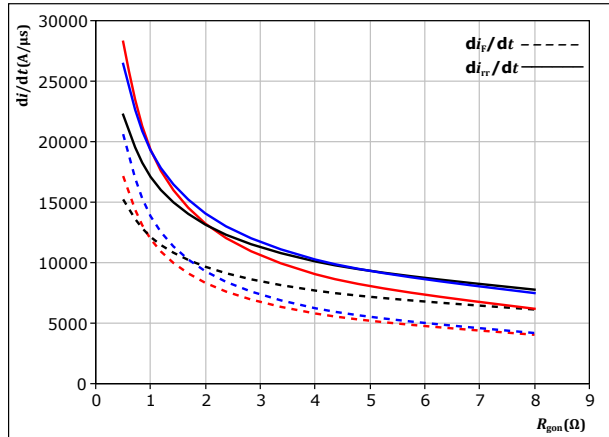
With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 2 \Omega$

$T_j = 25^\circ\text{C}$  (blue)  
 $T_j = 125^\circ\text{C}$  (black)  
 $T_j = 150^\circ\text{C}$  (red)

**figure 31.** FWD

Typical rate of fall of forward and reverse recovery current as a function of turn on gate resistor  
 $di_f/dt, di_r/dt = f(R_{gon})$



With an inductive load at

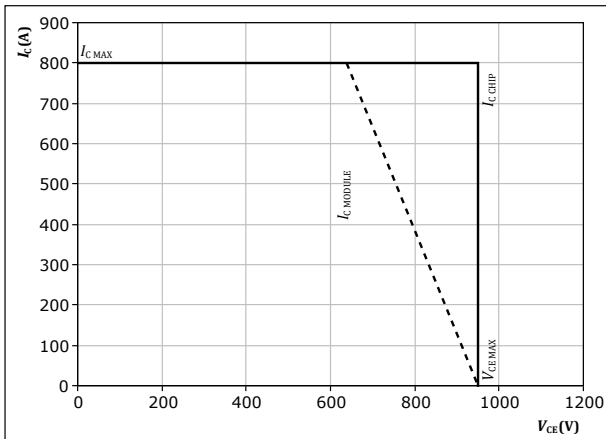
$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_C = 400 \text{ A}$

$T_j = 25^\circ\text{C}$  (blue)  
 $T_j = 125^\circ\text{C}$  (black)  
 $T_j = 150^\circ\text{C}$  (red)

**figure 32.** IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At  $T_j = 150^\circ\text{C}$   
 $R_{gon} = 2 \Omega$   
 $R_{goff} = 2 \Omega$





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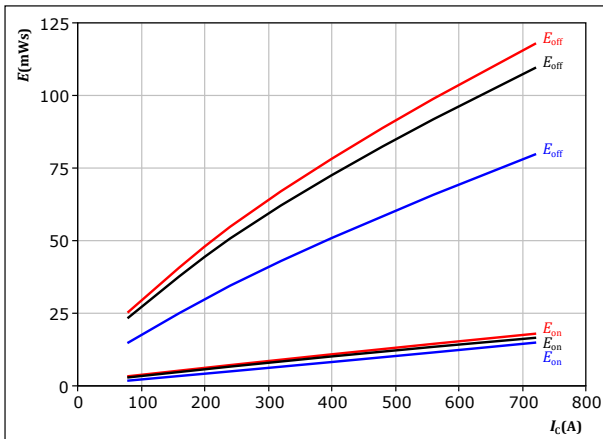
## Boost Switching Characteristics

figure 33.

IGBT

Typical switching energy losses as a function of collector current

$$E = f(I_C)$$



With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 2 \text{ } \Omega$   
 $R_{goff} = 2 \text{ } \Omega$

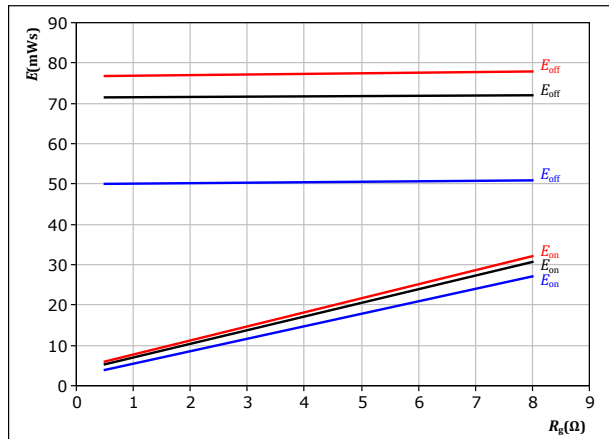
$T_j$ :  $25 \text{ } ^\circ\text{C}$  (blue)  
 $125 \text{ } ^\circ\text{C}$  (black)  
 $150 \text{ } ^\circ\text{C}$  (red)

figure 34.

IGBT

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

$$E = f(R_g)$$



With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_C = 400 \text{ A}$

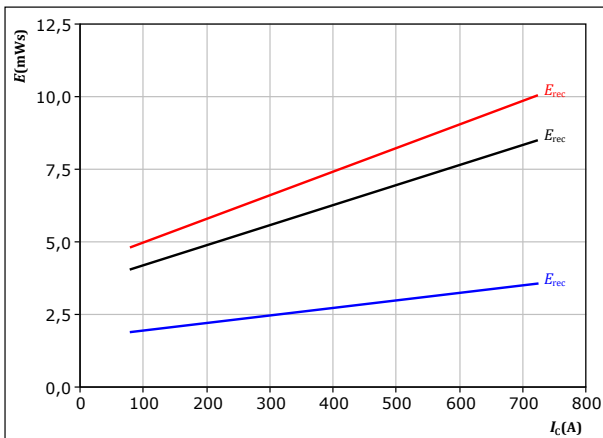
$T_j$ :  $25 \text{ } ^\circ\text{C}$  (blue)  
 $125 \text{ } ^\circ\text{C}$  (black)  
 $150 \text{ } ^\circ\text{C}$  (red)

figure 35.

FWD

Typical reverse recovered energy loss as a function of collector current

$$E_{rec} = f(I_C)$$



With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 2 \text{ } \Omega$

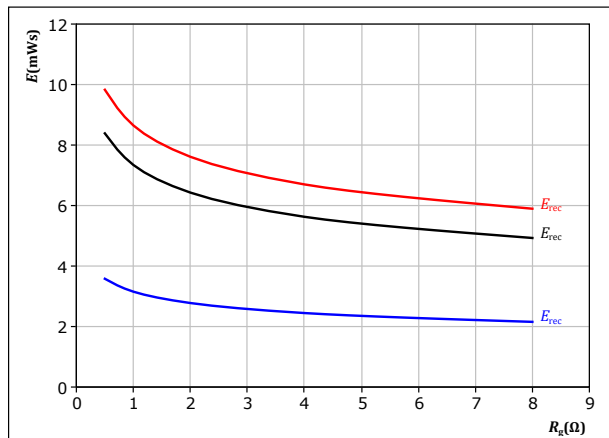
$T_j$ :  $25 \text{ } ^\circ\text{C}$  (blue)  
 $125 \text{ } ^\circ\text{C}$  (black)  
 $150 \text{ } ^\circ\text{C}$  (red)

figure 36.

FWD

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

$$E_{rec} = f(R_g)$$



With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_C = 400 \text{ A}$

$T_j$ :  $25 \text{ } ^\circ\text{C}$  (blue)  
 $125 \text{ } ^\circ\text{C}$  (black)  
 $150 \text{ } ^\circ\text{C}$  (red)



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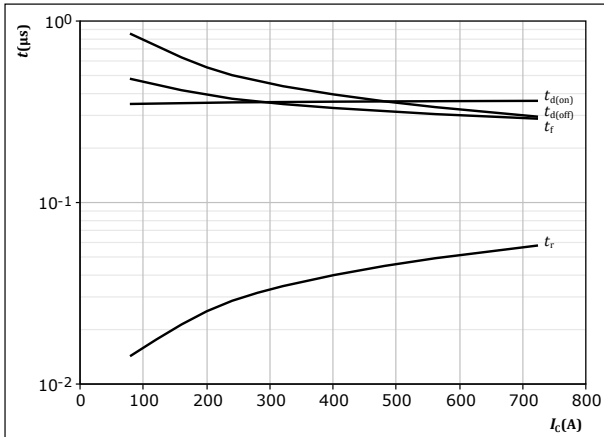
## Boost Switching Characteristics

figure 37.

IGBT

Typical switching times as a function of collector current

$$t = f(I_C)$$



With an inductive load at

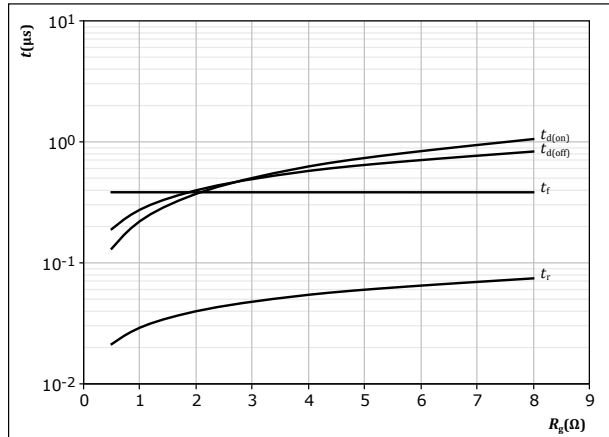
$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	$\pm 15$	V
$R_{gon} =$	2	$\Omega$
$R_{goff} =$	2	$\Omega$

figure 38.

IGBT

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

$$t = f(R_g)$$



With an inductive load at

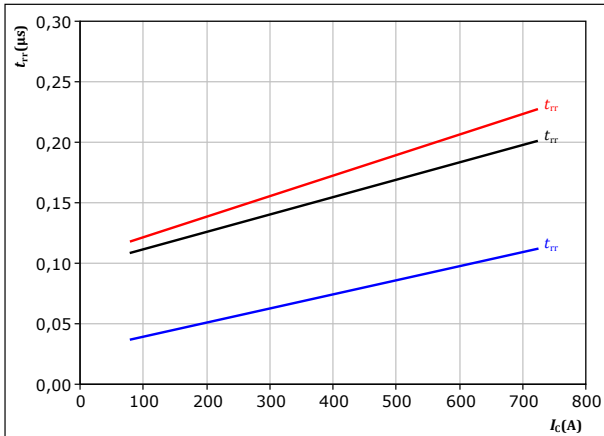
$T_j =$	150	°C
$V_{CE} =$	600	V
$V_{GE} =$	$\pm 15$	V
$I_C =$	400	A

figure 39.

FWD

Typical reverse recovery time as a function of collector current

$$t_{rr} = f(I_C)$$



With an inductive load at

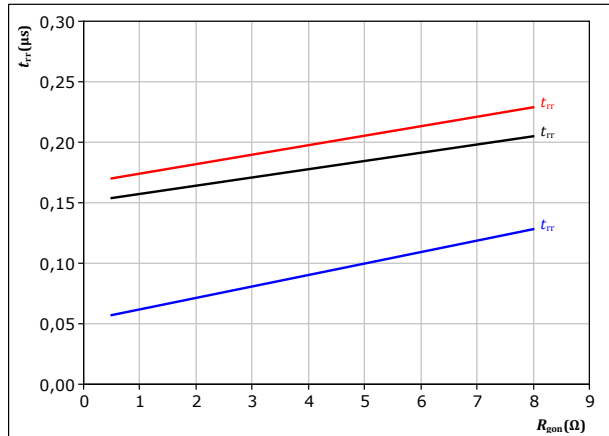
$V_{CE} =$	600	V	$T_j:$		125 °C
$V_{GE} =$	$\pm 15$	V			150 °C
$R_{gon} =$	2	$\Omega$			

figure 40.

FWD

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

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



With an inductive load at

$V_{CE} =$	600	V	$T_f:$		125 °C
$V_{GE} =$	$\pm 15$	V			150 °C
$I_C =$	400	A			



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# 30-FT10NIA400S702-LP59F04 datasheet

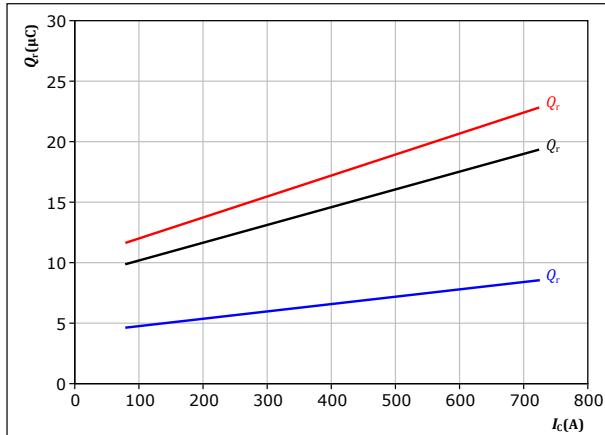
## Boost Switching Characteristics

figure 41.

FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 2$   $\Omega$

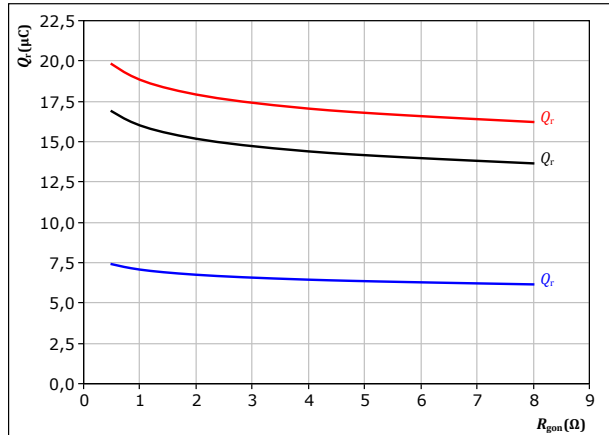
$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

figure 42.

FWD

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

$$Q_r = f(R_{gon})$$



With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 400$  A

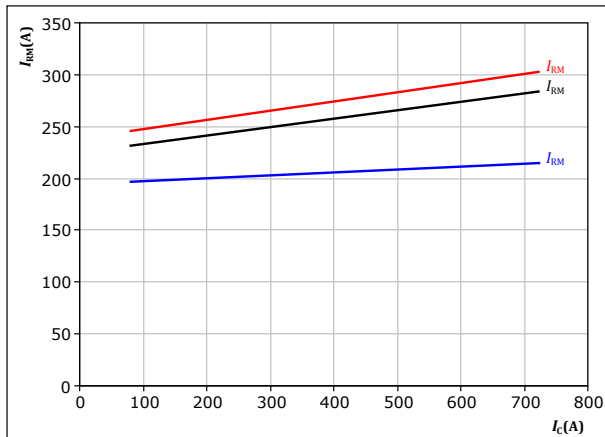
$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

figure 43.

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  
 $V_{GE} = \pm 15$  V  
 $R_{gon} = 2$   $\Omega$

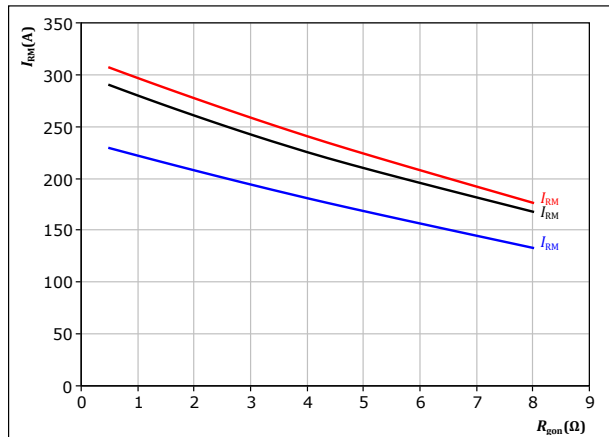
$T_j$ : — 25 °C  
— 125 °C  
— 150 °C

figure 44.

FWD

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

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



With an inductive load at

$V_{CE} = 600$  V  
 $V_{GE} = \pm 15$  V  
 $I_c = 400$  A

$T_j$ : — 25 °C  
— 125 °C  
— 150 °C



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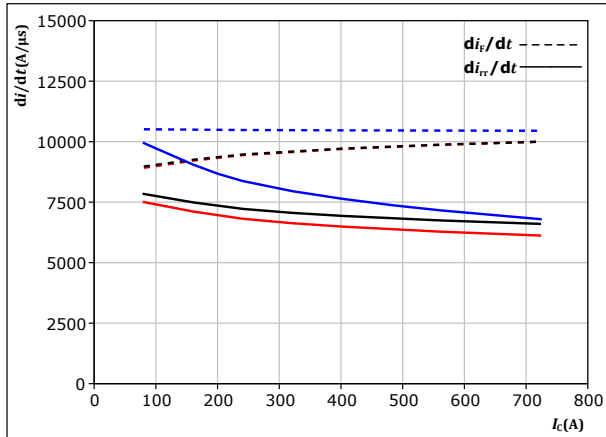
# 30-FT10NIA400S702-LP59F04

datasheet

## Boost Switching Characteristics

figure 45. FWD

Typical rate of fall of forward and reverse recovery current as a function of collector current  
 $di_f/dt, di_r/dt = f(I_C)$

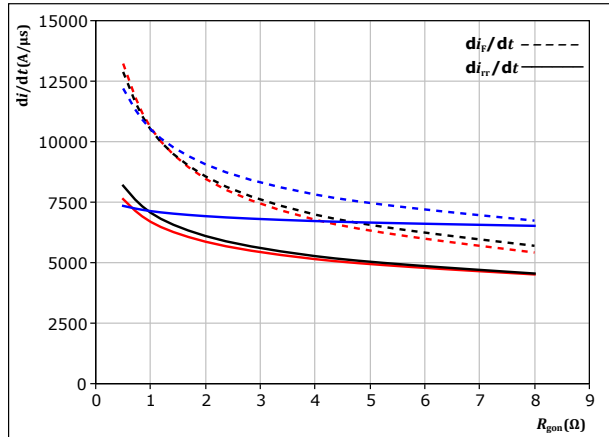


With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $R_{gon} = 2 \text{ } \Omega$   
 $T_j = 25 \text{ } ^\circ\text{C}$   
 $T_j = 125 \text{ } ^\circ\text{C}$   
 $T_j = 150 \text{ } ^\circ\text{C}$

figure 46. FWD

Typical rate of fall of forward and reverse recovery current as a function of turn on gate resistor  
 $di_f/dt, di_r/dt = f(R_{gon})$



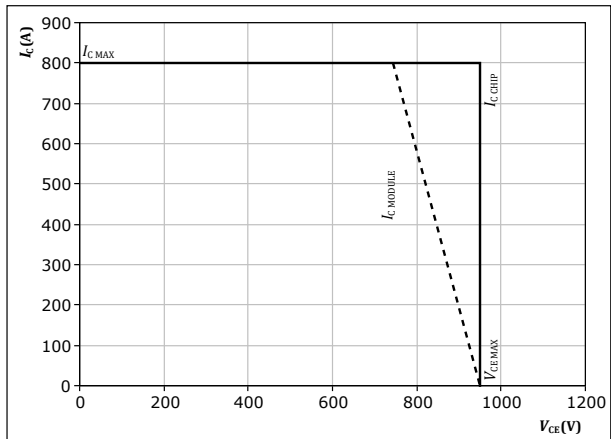
With an inductive load at

$V_{CE} = 600 \text{ V}$   
 $V_{GE} = \pm 15 \text{ V}$   
 $I_C = 400 \text{ A}$   
 $T_j = 25 \text{ } ^\circ\text{C}$   
 $T_j = 125 \text{ } ^\circ\text{C}$   
 $T_j = 150 \text{ } ^\circ\text{C}$

figure 47. IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At  $T_j = 150 \text{ } ^\circ\text{C}$   
 $R_{gon} = 2 \text{ } \Omega$   
 $R_{goff} = 2 \text{ } \Omega$



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# 30-FT10NIA400S702-LP59F04 datasheet

## Switching Definitions

figure 48. IGBT

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



figure 49. IGBT

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



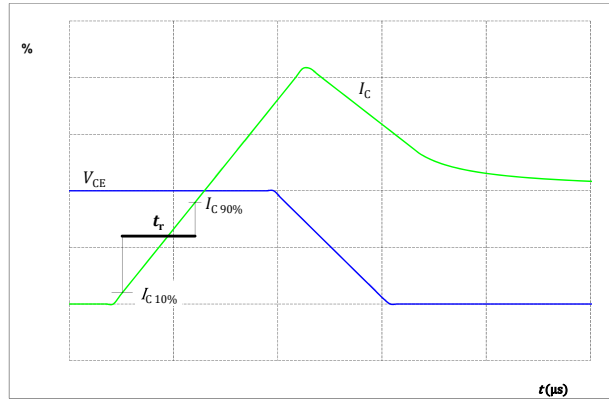
figure 50. IGBT

Turn-off Switching Waveforms & definition of  $t_f$



figure 51. IGBT

Turn-on Switching Waveforms & definition of  $t_r$





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## 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  $Q_r$ )





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datasheet

Ordering Code	
Version	Ordering Code
Without thermal paste	30-FT10NIA400S702-LP59F04
With thermal paste (5,2 W/mK, PTM6000HV)	30-FT10NIA400S702-LP59F04-/7/

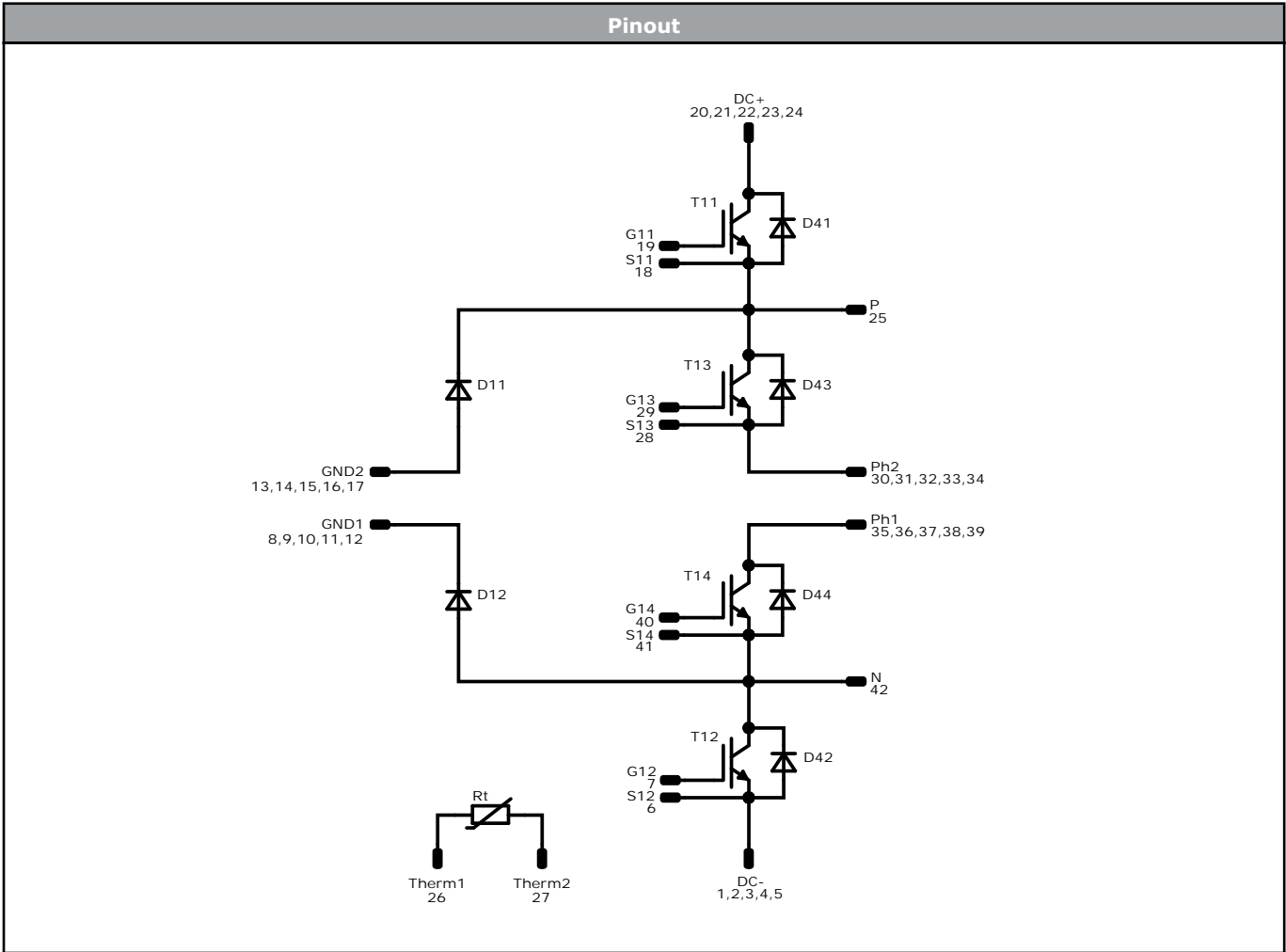
Marking						
	Text	Name	Date code	UL & VIN	Lot	Serial
		NN-NNNNNNNNNNNNNNNN- TTTTWWYY	WWYY	UL VIN	LLLL	SSSS
	Datamatrix	Type&Ver	Lot number	Serial	Date code	
		TTTTTTVV	LLLLL	SSSS	WWYY	

Outline				
Pin table [mm]				
Pin	X	Y	Function	
1	70,9	0	DC-	
2	68,2	0	DC-	
3	65,5	0	DC-	
4	62,8	0	DC-	
5	60,1	0	DC-	
6	70,9	10,8	S12	
7	67,85	10,8	G12	
8	48,8	0	GND1	
9	46,1	0	GND1	
10	43,4	0	GND1	
11	40,7	0	GND1	
12	38	0	GND1	
13	32,9	0	GND2	
14	30,2	0	GND2	
15	27,5	0	GND2	
16	24,8	0	GND2	
17	22,1	0	GND2	
18	19,35	9,1	S11	
19	16,3	9,1	G11	
20	10,8	0	DC+	
21	8,1	0	DC+	
22	5,4	0	DC+	
23	2,7	0	DC+	
24	0	0	DC+	
25	19,75	18,7	P	
26	0	36,9	Therm1	
27	3	36,9	Therm2	
28	12,2	35,95	S13	
29	12,15	32,35	G13	
30	22,2	36,9	Ph2	
31	24,9	36,9	Ph2	
32	27,6	36,9	Ph2	
33	30,3	36,9	Ph2	
34	33	36,9	Ph2	
35	37,9	36,9	Ph1	
36	40,6	36,9	Ph1	
37	43,3	36,9	Ph1	
38	46	36,9	Ph1	
39	48,7	36,9	Ph1	
40	52,3	20,7	G14	
41	49,1	20,7	S14	
42	45,55	19,35	N	



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Identification					
ID	Component	Voltage	Current	Function	Comment
T11, T12	IGBT	950 V	400 A	Buck Switch	
D11, D12	FWD	1200 V	100 A	Buck Diode	
T13, T14	IGBT	950 V	400 A	Boost Switch	
D42, D41	FWD	950 V	200 A	Boost Diode	
D43, D44	FWD	950 V	200 A	Boost Sw. Inv. Diode	
Rt	NTC			Thermistor	





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datasheet

Packaging instruction				
Standard packaging quantity (SPQ) 36	>SPQ	Standard	<SPQ	Sample
Handling instruction				
Handling instructions for <i>flow 2</i> packages see vincotech.com website.				
Package data				
Package data for <i>flow 2</i> 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 $T_{j,sp}=175^{\circ}\text{C}$ and up to 4000VAC/1min isolation voltage. For more information see vincotech.com website.				

Document No.:	Date:	Modification:	Pages
30-FT10NIA400S702-LP59F04-D3-14	16 Jul. 2025	Change Buck Diode	

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.