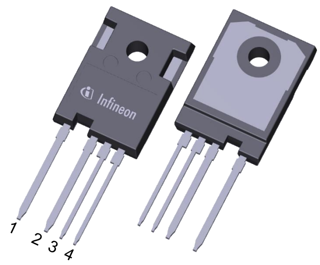
Final datasheet

Short circuit rugged 1200 V TRENCHSTOP™ IGBT 7 technology co-packed with soft and fast recovery diode

Features

- V_{CE} = 1200 V
- I_C = 40 A
- Very low V_{CEsat} = 1.65 V (typ.) at I_{Cnom} = 40 A, 25°C
- Short circuit robust t_{sc} = 4 µs at V_{CE} = 800 V, V_{GE} = 15 V
- Smooth switching characteristics
- 30% Less Turn On Energy loss compared to 3 pin devices due to Kelvin emitter
- Wide range of dv/dt controllability
- TO247 package with high creepage distance
- Simple gate drive design
- Co-packed with fast soft recovery emitter controlled 7 diode
- Low EMI signature
- High reliability and operating lifetime



AEC Qualified

Halogen-free

RoHS

Potential applications

- DC-link discharge switch
- Automotive aux-drives
- Automotive HV heaters

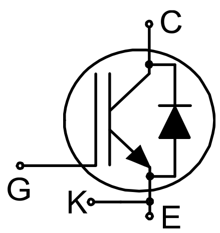
Product validation

- Qualified for automotive applications. Product Validation according to AEC-Q101

Description

Package pin definition:

- Pin C (1) & backside - collector
- Pin E (2) - emitter
- Pin K (3) - Kelvin emitter
- Pin G (4) - gate



Type	Package	Marking
AIKZH40N120CS7	PG-TO247-4-U03	AZ12S7040

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1 Package

Table 1 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Internal emitter inductance	L_E			13		nH
Storage temperature	T_{stg}		-55		150	°C
Soldering temperature	T_{sold}	Wave soldering 1.6 mm (0.063 in.) from case for 10 s			260	°C
Mounting torque	M	M3 screw, Maximum of mounting processes: 3			0.6	Nm
Thermal resistance, junction-ambient	$R_{th(j-a)}$				40	K/W
IGBT thermal resistance, junction-case	$R_{th(j-c)}$			0.3	0.42	K/W
Diode thermal resistance, junction-case	$R_{th(j-c)}$			0.55	0.75	K/W

2 IGBT

Table 2 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CE}	$T_{vj} \geq 25$ °C		1200	V
DC collector current, limited by T_{vjmax}	I_C	limited by bondwire	$T_c = 25$ °C	97	A
			$T_c = 100$ °C	68	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}			160	A
Turn-off safe operating area		$V_{CE} \leq 1200$ V, $t_p \leq 1$ µs, $T_{vj} \leq 175$ °C		160	A
Gate-emitter voltage	V_{GE}			±20	V
Transient gate-emitter voltage	V_{GE}	$D = <0.01$		±25	V
Short-circuit withstand time	t_{SC}	$V_{CC} \leq 800$ V, $V_{GE} = -8/15$ V, Allowed number of short circuits < 1000, Time between short circuits ≥ 1.0 s, $T_{vj} = 175$ °C		4	µs
Power dissipation	P_{tot}	$T_{vj} = 175$ °C	$T_c = 25$ °C	357	W
			$T_c = 100$ °C	179	

Table 3 **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	V_{CEsat}	I_C = 40 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.61	2	V
			T_{vj} = 175 °C		1.94		
Gate-emitter threshold voltage	V_{GEth}	I_C = 0.78 mA, $V_{CE} = V_{GE}$		5.15	5.72	6.45	V
Zero gate-voltage collector current	I_{CES}	V_{CE} = 1200 V, V_{GE} = 0 V	T_{vj} = 25 °C			40	µA
			T_{vj} = 175 °C		1600		
Gate-emitter leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = 20 V				100	nA
Transconductance	g_{fs}	I_C = 40 A, V_{CE} = 20 V, T_{vj} = 175 °C			27.9		S
Short-circuit collector current	I_{SC}	V_{CC} ≤ 800 V, V_{GE} = -8/15 V, t_{SC} ≤ 4 µs, Allowed number of short circuits < 1000 , Time between short circuits ≥ 1.0 s	T_{vj} = 25 °C		271		A
			T_{vj} = 175 °C		217		
Internal gate resistance	$R_{G,int}$	f = 100 kHz			5.2		Ω
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz			5.5		nF
Output capacitance	C_{oes}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz			118		pF
Reverse transfer capacitance	C_{res}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz			28		pF
Gate charge	Q_G	V_{CC} = 960 V, I_C = 40 A, V_{GE} = -8/15 V			336		nC
Turn-on delay time	$t_{d(on)}$	V_{CC} = 800 V, V_{GE} = -8/15 V, R_G = 4.5 Ω	T_{vj} = 25 °C, I_C = 40 A		26		ns
			T_{vj} = 175 °C, I_C = 40 A		33		
Rise time (inductive load)	t_r	V_{CC} = 800 V, V_{GE} = -8/15 V, R_G = 4.5 Ω	T_{vj} = 25 °C, I_C = 40 A		10		ns
			T_{vj} = 175 °C, I_C = 40 A		14		
Turn-off delay time	$t_{d(off)}$	V_{CC} = 800 V, V_{GE} = -8/15 V, R_G = 4.5 Ω	T_{vj} = 25 °C, I_C = 40 A		147		ns
			T_{vj} = 175 °C, I_C = 40 A		242		
Fall time (inductive load)	t_f	V_{CC} = 800 V, V_{GE} = -8/15 V, R_G = 4.5 Ω	T_{vj} = 25 °C, I_C = 40 A		76		ns
			T_{vj} = 175 °C, I_C = 40 A		180		

(table continues...)

Table 3 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Turn-on energy[1]	E_{on}	V_{CC} = 800 V, V_{GE} = -8/15 V, R_G = 4.5 Ω	T_{vj} = 25 °C, I_C = 40 A		2.29		mJ
			T_{vj} = 175 °C, I_C = 40 A		4.27		
Turn-off energy	E_{off}	V_{CC} = 800 V, V_{GE} = -8/15 V, R_G = 4.5 Ω	T_{vj} = 25 °C, I_C = 40 A		2.2		mJ
			T_{vj} = 175 °C, I_C = 40 A		4.9		
Total switching energy	E_{ts}	V_{CC} = 800 V, V_{GE} = -8/15 V, R_G = 4.5 Ω	T_{vj} = 25 °C, I_C = 40 A		4.48		mJ
			T_{vj} = 175 °C, I_C = 40 A		9.18		
Operating junction temperature	T_{vj}			-40		175	°C

1) Includes IGBT losses caused by reverse recovery current

3 Diode

Table 4 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}	T_{vj} ≥ 25 °C		1200	V
Diode forward current, limited by T_{vjmax}	I_F		T_c = 25 °C	88	A
			T_c = 100 °C	54	
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpulse}			160	A
Power dissipation	P_{tot}	T_{vj} = 175 °C	T_c = 25 °C	200	W
			T_c = 100 °C	100	

Table 5 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode forward voltage	V_F	I_F = 40 A	T_{vj} = 25 °C		1.66	2.15	V
			T_{vj} = 175 °C		1.6		

(table continues...)

Table 5 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode reverse recovery charge	Q_{rr}		T_{vj} = 25 °C, I_F = 40 A		2.7		µC
			T_{vj} = 175 °C, I_F = 40 A		7.24		
Diode peak reverse recovery current	I_{rrm}		T_{vj} = 25 °C, I_F = 40 A		61.9		A
			T_{vj} = 175 °C, I_F = 40 A		78.3		
Diode reverse recovery energy	E_{rec}		T_{vj} = 25 °C, I_F = 40 A		1.16		mJ
			T_{vj} = 175 °C, I_F = 40 A		3.46		
Operating junction temperature	T_{vj}			-40		175	°C

***Note**: For optimum lifetime and reliability, Infineon recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.*

Electrical Characteristic at T_{vj} = 25°C, unless otherwise specified.

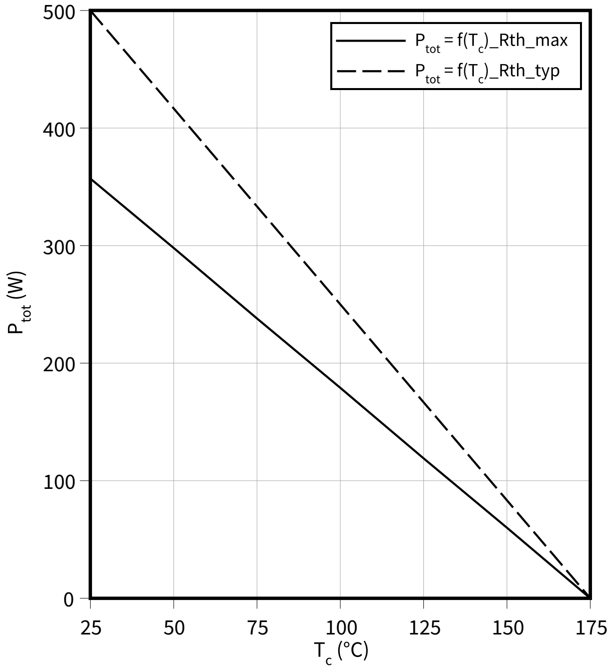
Dynamic test circuit, parasitic inductance L_σ = 30 nH, C_σ = 8 pF.

4 Characteristics diagrams

Power dissipation as a function of case temperature

$P_{tot} = f(T_c)$

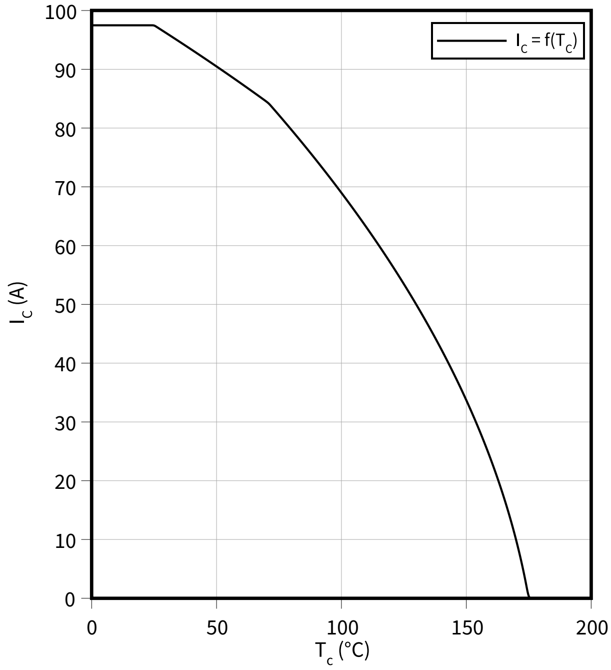
$T_{vj} \leq 175$ °C



Collector current as a function of case temperature

$I_C = f(T_c)$

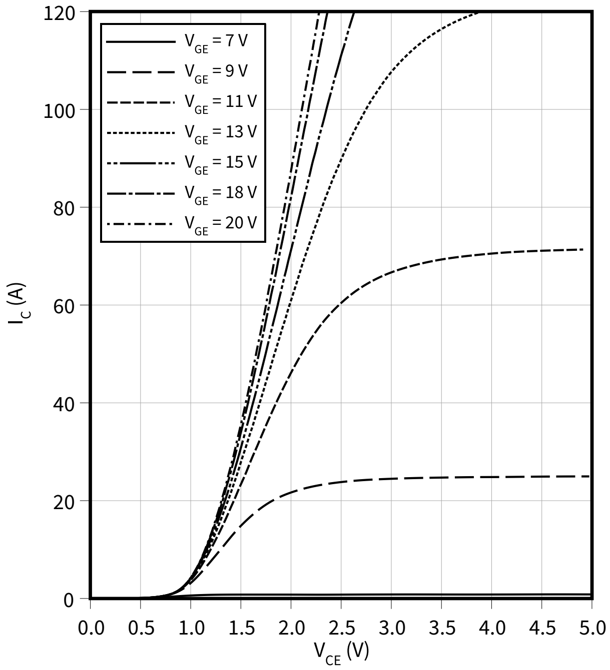
$T_{vj} \leq 175$ °C, $V_{GE} \geq 15$ V



Typical output characteristic

$I_C = f(V_{CE})$

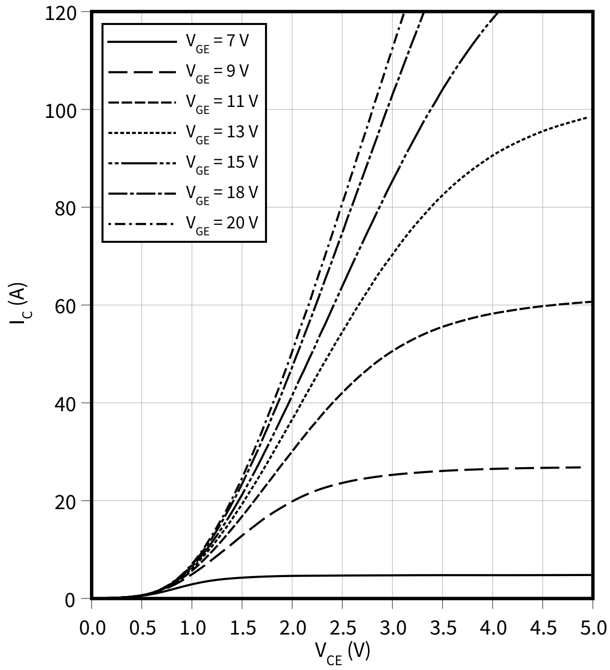
$T_{vj} = 25$ °C



Typical output characteristic

$I_C = f(V_{CE})$

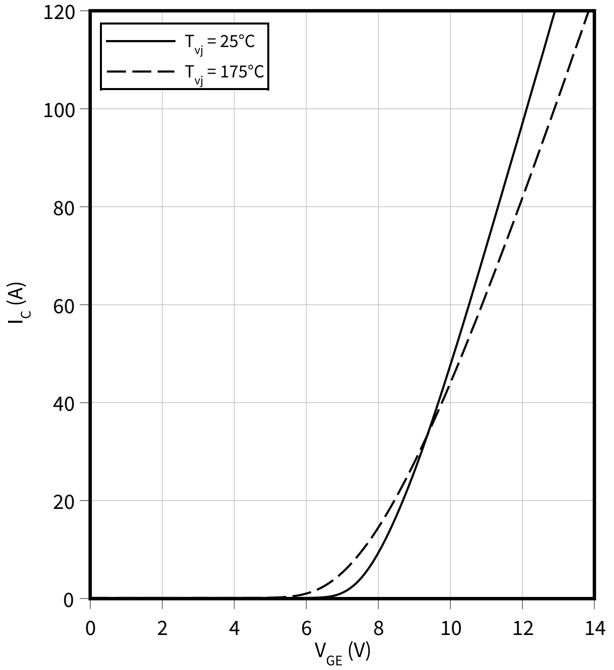
$T_{vj} = 175$ °C



Typical transfer characteristic

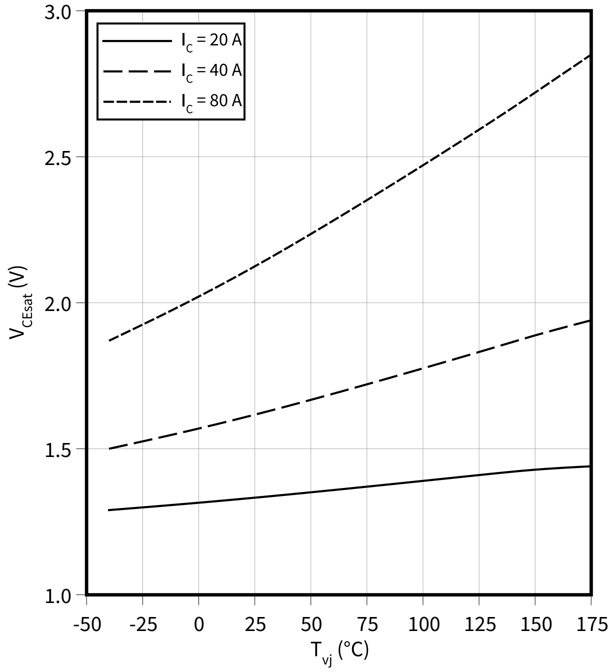
$I_C = f(V_{GE})$

$V_{CE} = 20$ V



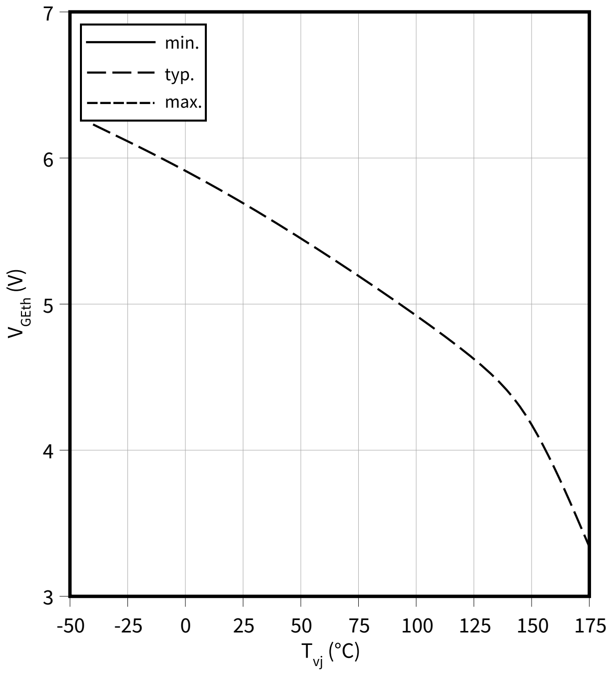
Typical collector-emitter saturation voltage as a function of junction temperature

$V_{CEsat} = f(T_{vj})$



Gate-emitter threshold voltage as a function of junction temperature

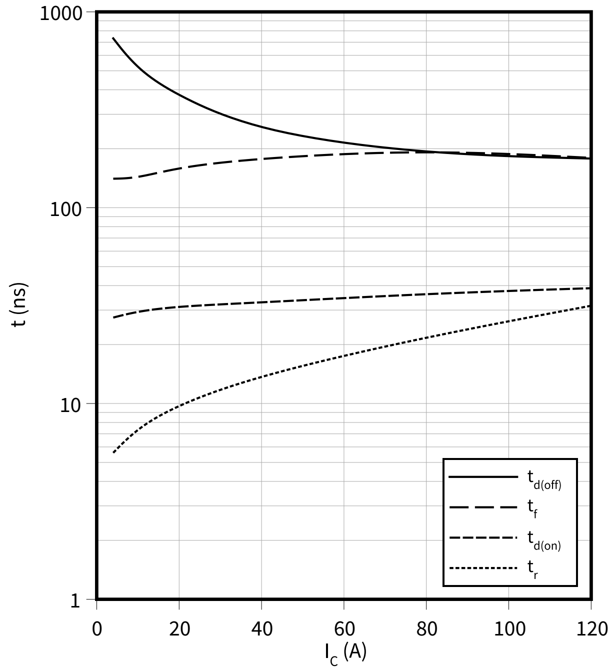
$V_{GEth} = f(T_{vj})$



Typical switching times as a function of collector current

$t = f(I_C)$

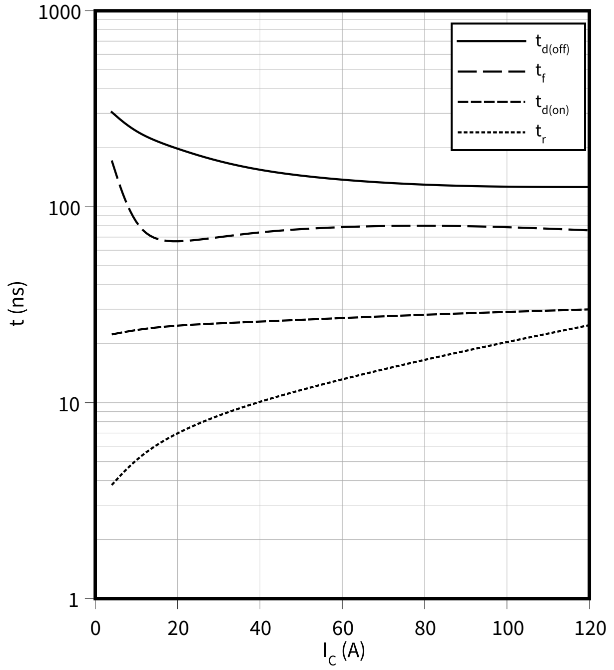
$V_{CC} = 800$ V, $T_{vj} = 175$ °C, $R_G = 4.5$ Ω



Typical switching times as a function of collector current

$t = f(I_C)$

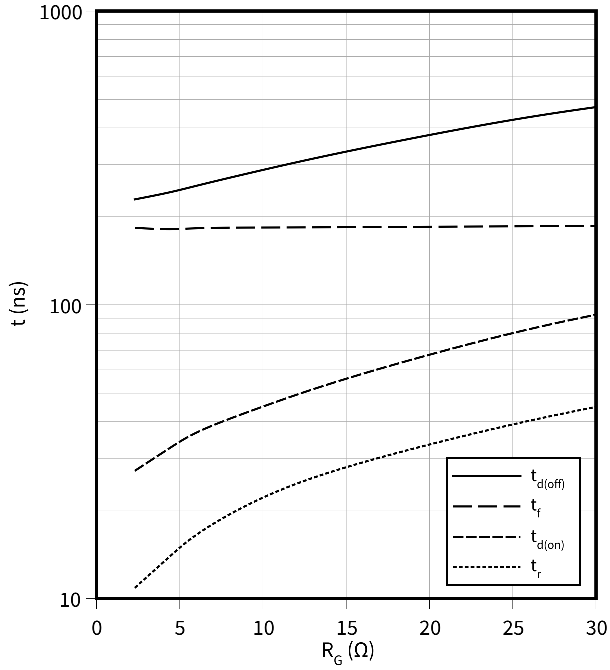
$V_{CC} = 800$ V, $T_{vj} = 25$ °C, $R_G = 4.5\ \Omega$



Typical switching times as a function of gate resistor

$t = f(R_G)$

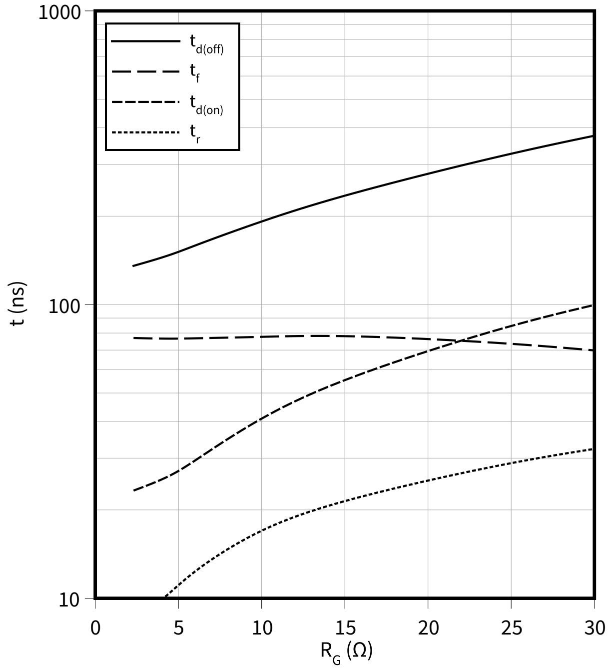
$I_C = 40$ A, $V_{CC} = 800$ V, $T_{vj} = 175$ °C



Typical switching times as a function of gate resistor

$t = f(R_G)$

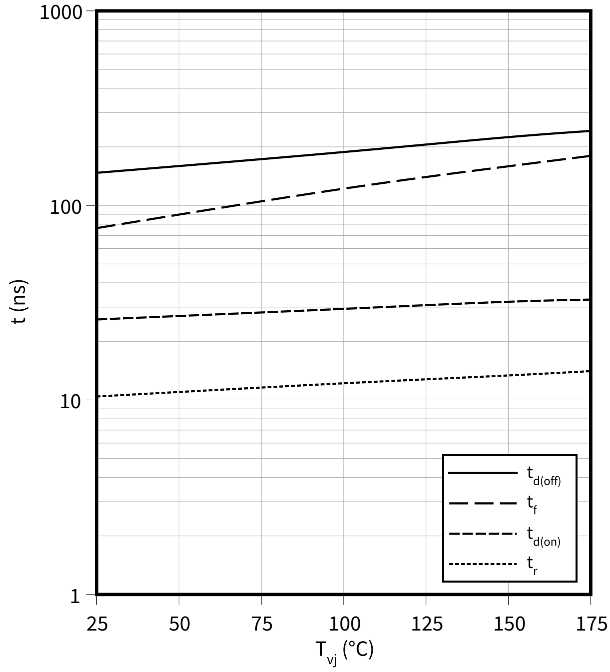
$I_C = 40$ A, $V_{CC} = 800$ V, $T_{vj} = 25$ °C



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

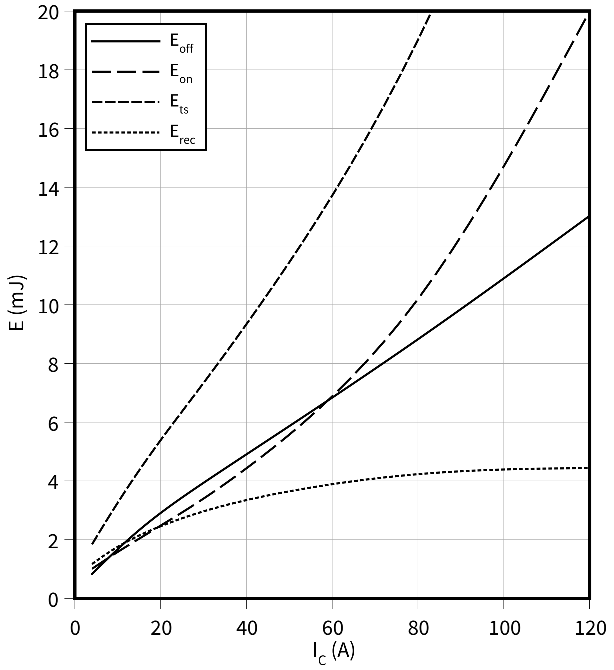
$I_C = 40$ A, $V_{CC} = 800$ V, $R_G = 4.5\ \Omega$



Typical switching energy losses as a function of collector current

$E = f(I_C)$

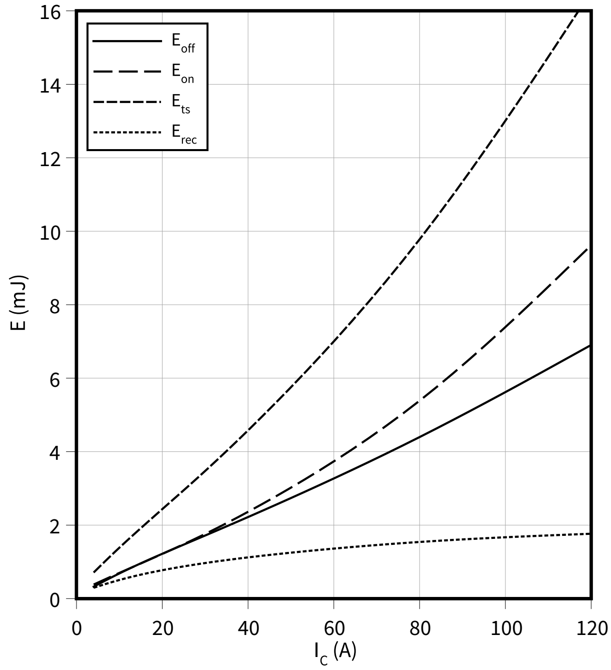
V_{CC} = 800 V, T_{vj} = 175 °C, R_G = 4.5 Ω



Typical switching energy losses as a function of collector current

$E = f(I_C)$

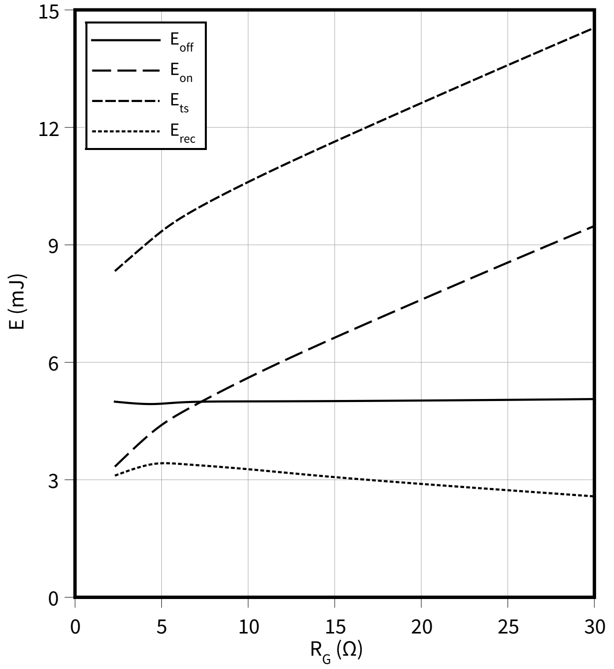
V_{CC} = 800 V, T_{vj} = 25 °C, R_G = 4.5 Ω



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

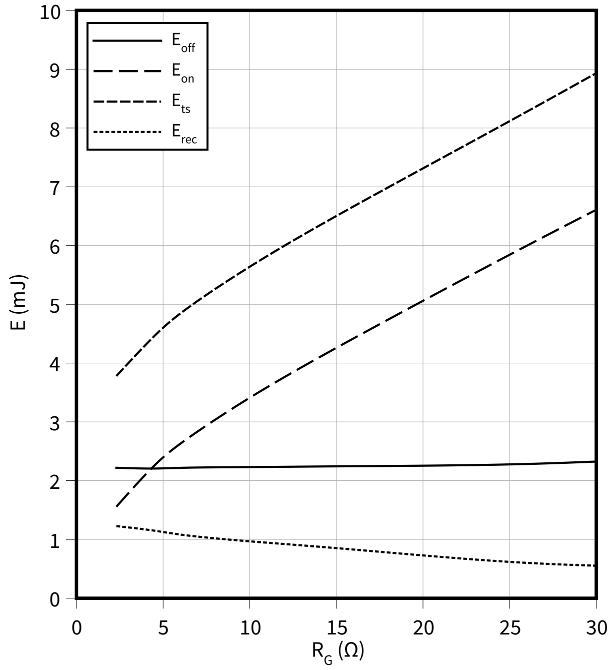
I_C = 40 A, V_{CC} = 800 V, T_{vj} = 175 °C



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

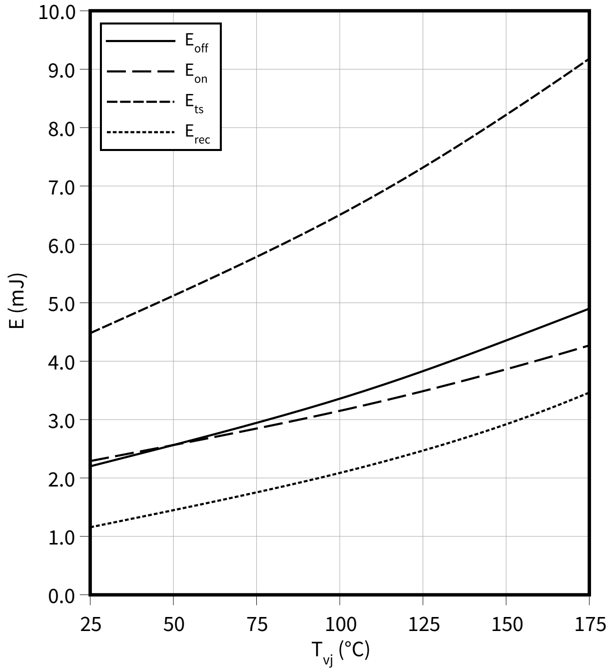
I_C = 40 A, V_{CC} = 800 V, T_{vj} = 25 °C



Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

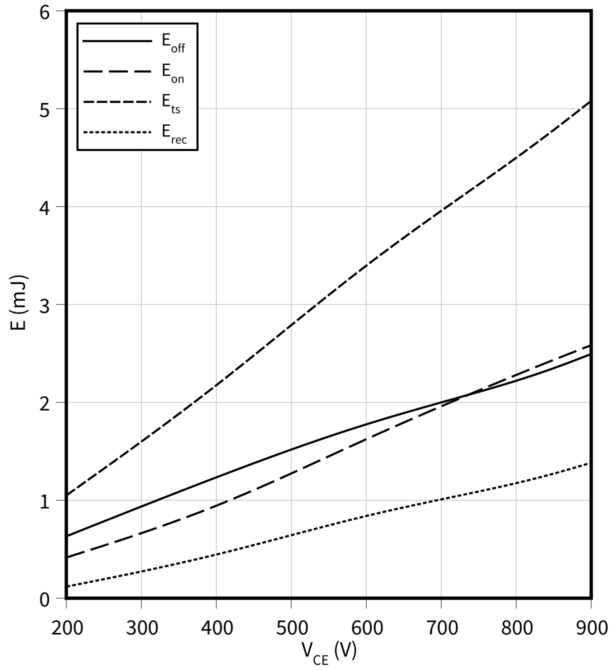
$I_C = 40$ A, $V_{CC} = 800$ V, $R_G = 4.5\ \Omega$



Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$

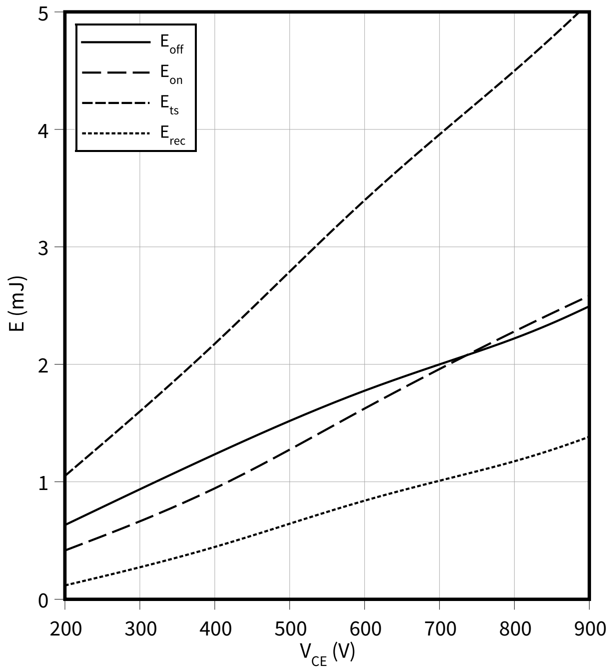
$I_C = 40$ A, $T_{vj} = 175$ °C, $R_G = 4.5\ \Omega$



Typical switching energy losses as a function of collector emitter voltage

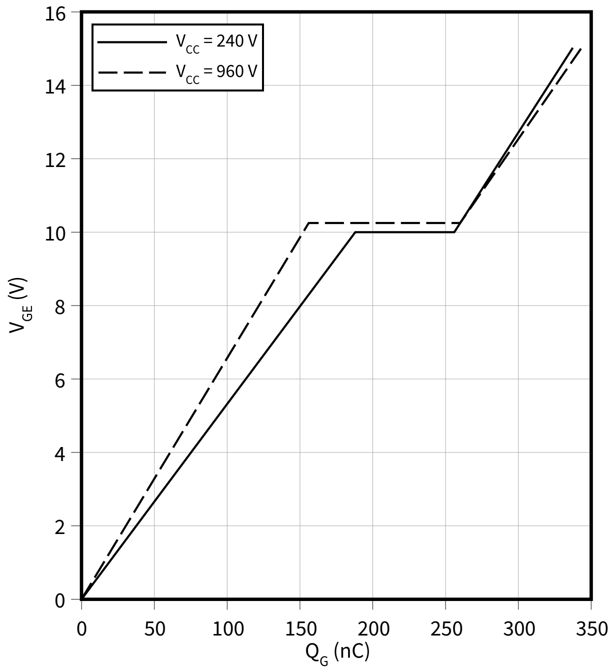
$E = f(V_{CE})$

$I_C = 40$ A, $T_{vj} = 25$ °C, $R_G = 4.5\ \Omega$



Typical gate charge

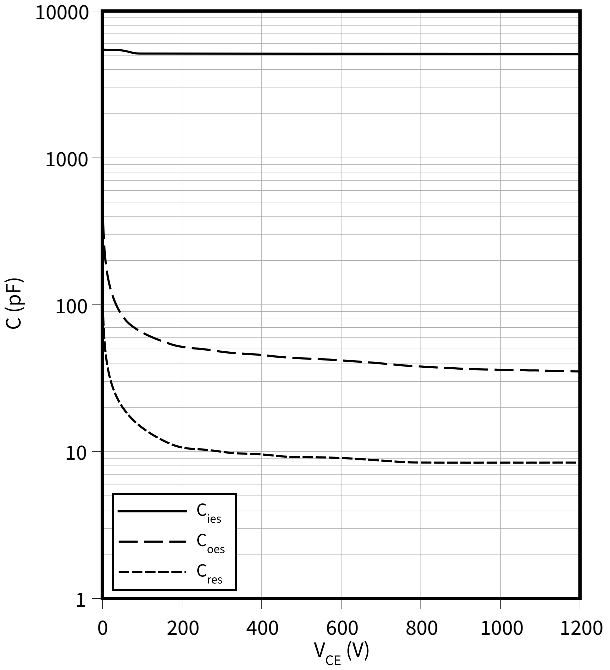
$V_{GE} = f(Q_G)$



Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE})$

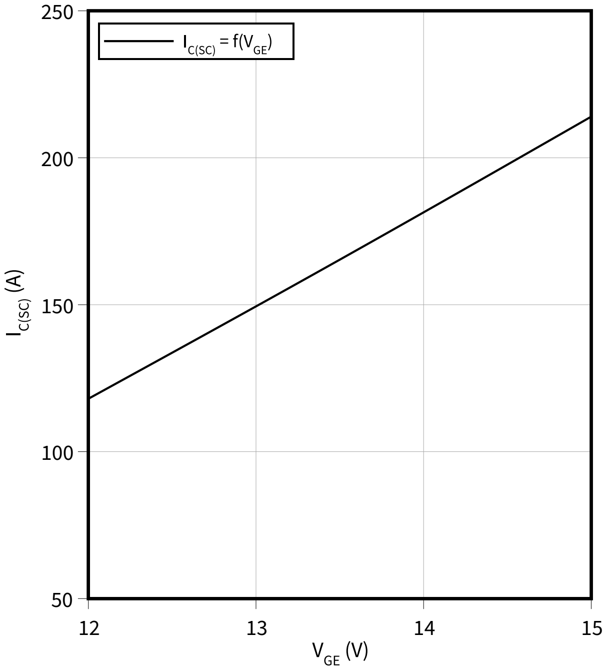
$f = 100$ kHz, $V_{GE} = 0$ V



Typical short circuit collector current as a function of gate-emitter voltage

$I_{C(SC)} = f(V_{GE})$

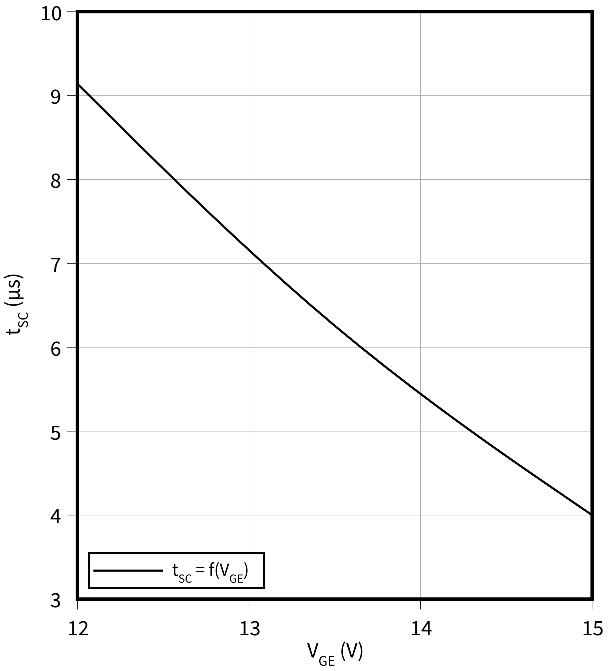
$T_{vj} = 175$ °C, $V_{CC} = 800$ V



Short circuit withstand time as a function of gate-emitter voltage

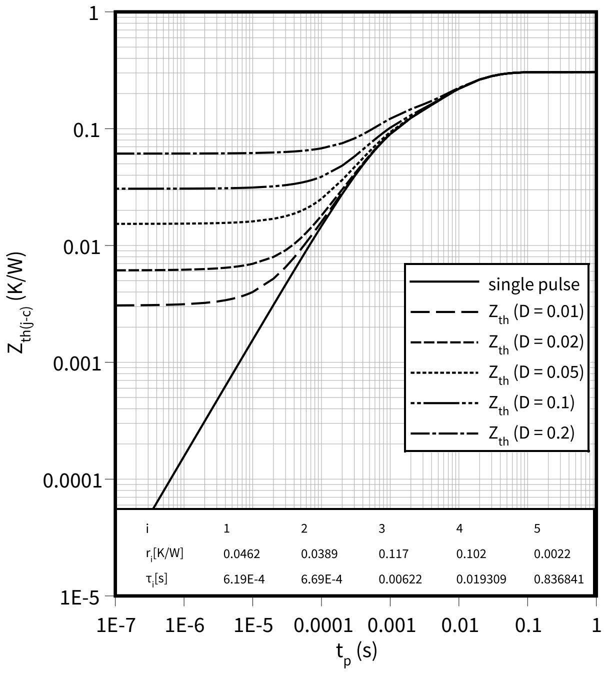
$t_{SC} = f(V_{GE})$

$T_{vj} = 175$ °C, $V_{CC} = 800$ V



IGBT typical transient thermal impedance as a function of pulse width

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

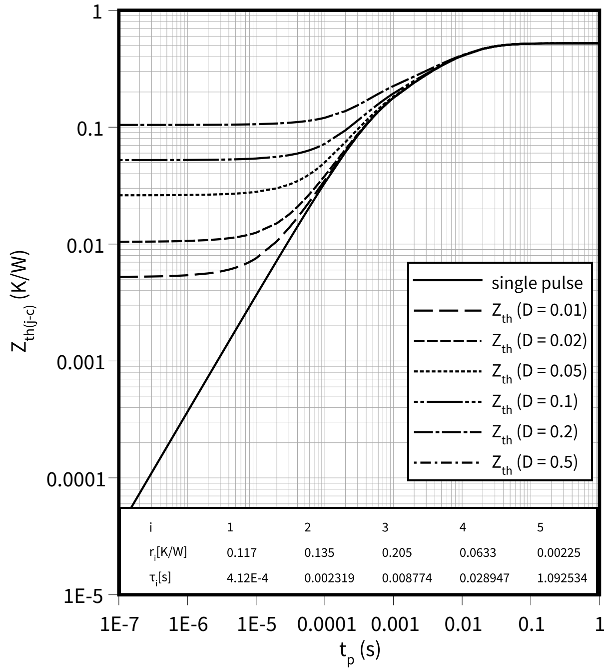


i	1	2	3	4	5
r_i[K/W]	0.0462	0.0389	0.117	0.102	0.0022
τ_i[s]	6.19E-4	6.69E-4	0.00622	0.019309	0.836841

Diode typical transient thermal impedance as a function of pulse width

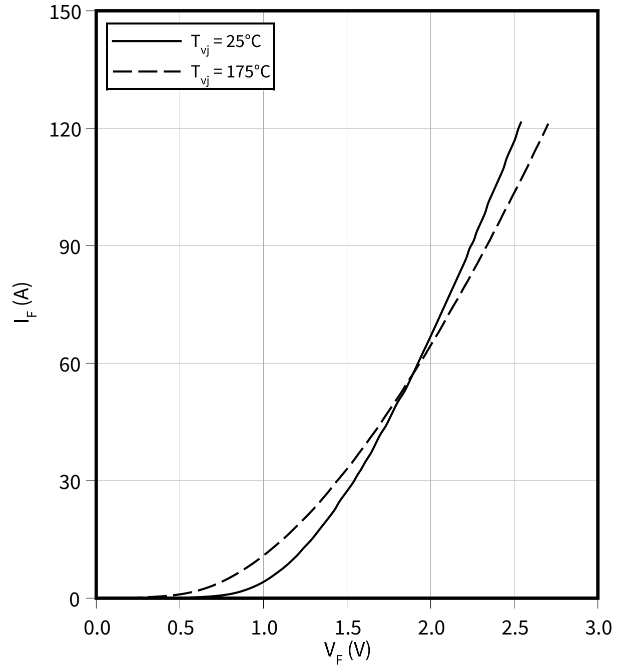
$Z_{th(j-c)} = f(t_p)$

$D = t_p/T$



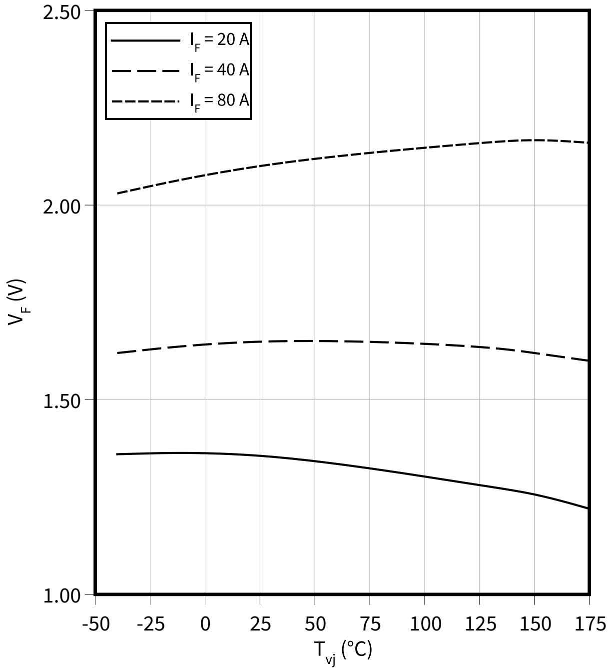
Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



Typical diode forward voltage as a function of junction temperature

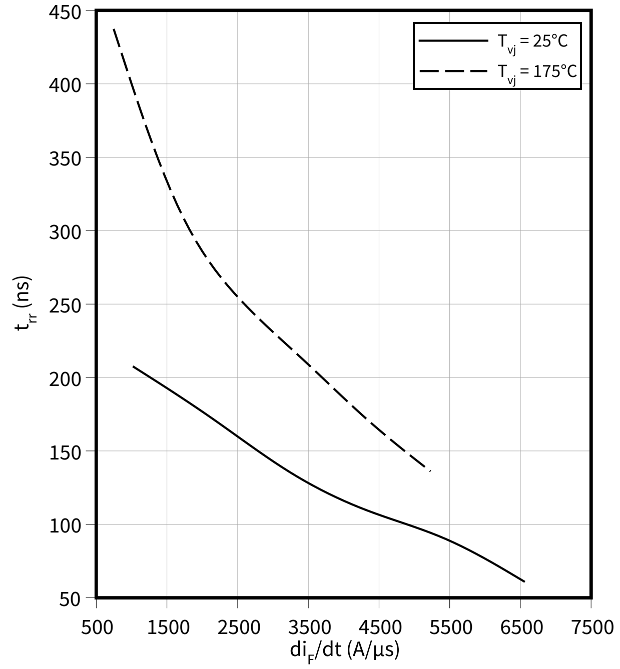
$V_F = f(T_{vj})$



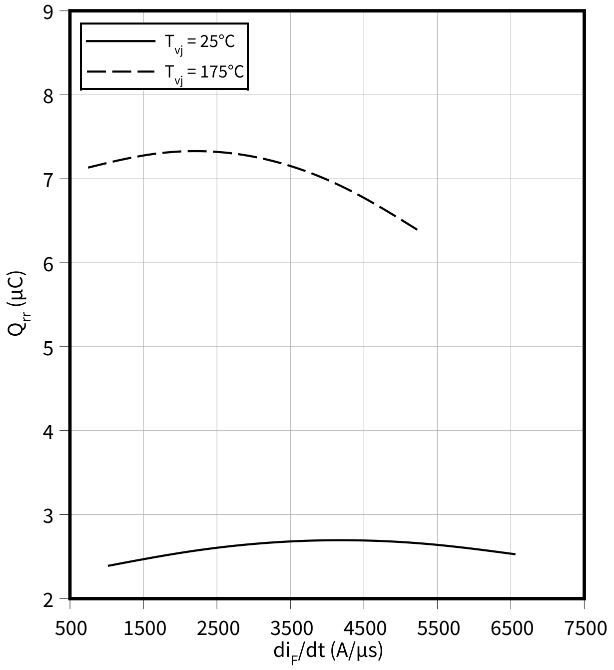
Typical reverse recovery time as a function of diode current slope

$t_{rr} = f(di_F/dt)$

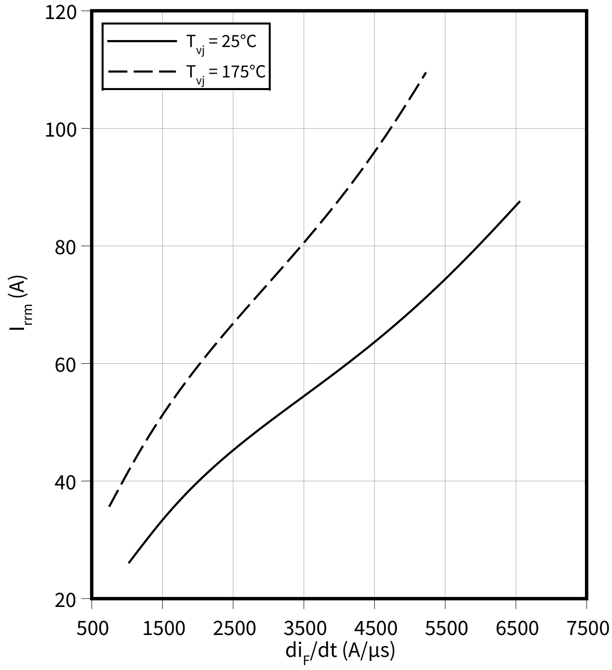
$V_R = 800$ V, $I_F = 40$ A



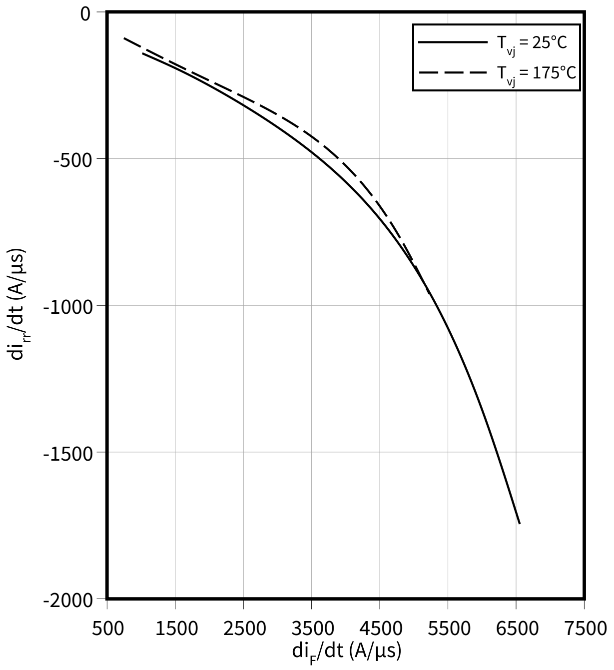
Typical reverse recovery charge as a function of diode current slope
$Q_{rr} = f(di_F/dt)$
$V_R = 800$ V, $I_F = 40$ A



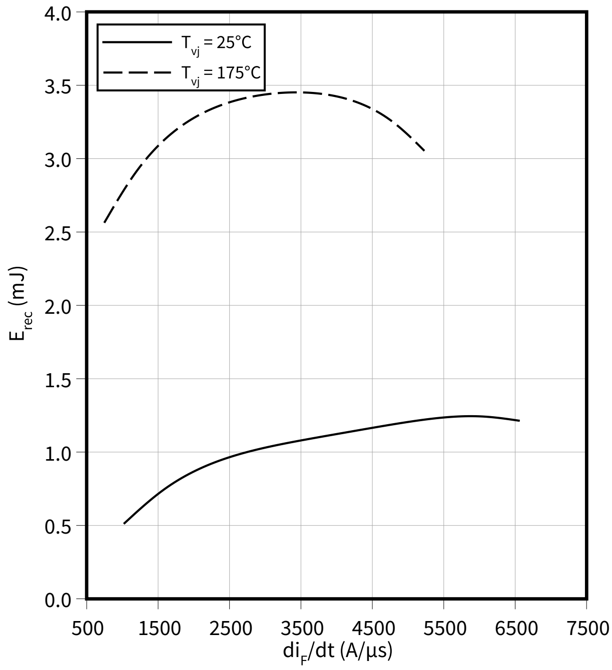
Typical reverse recovery current as a function of diode current slope
$I_{rrm} = f(di_F/dt)$
$V_R = 800$ V, $I_F = 40$ A



Typical diode peak rate of fall of reverse recovery current as a function of diode current slope
$di_{rr}/dt = f(di_F/dt)$
$V_R = 800$ V, $I_F = 40$ A



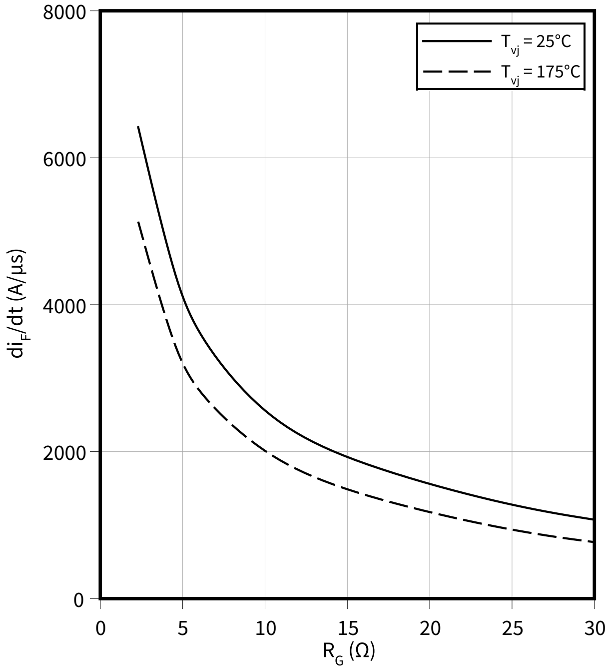
Typical reverse energy losses as a function of diode current slope
$E_{rec} = f(di_F/dt)$
$V_R = 800$ V, $I_F = 40$ A



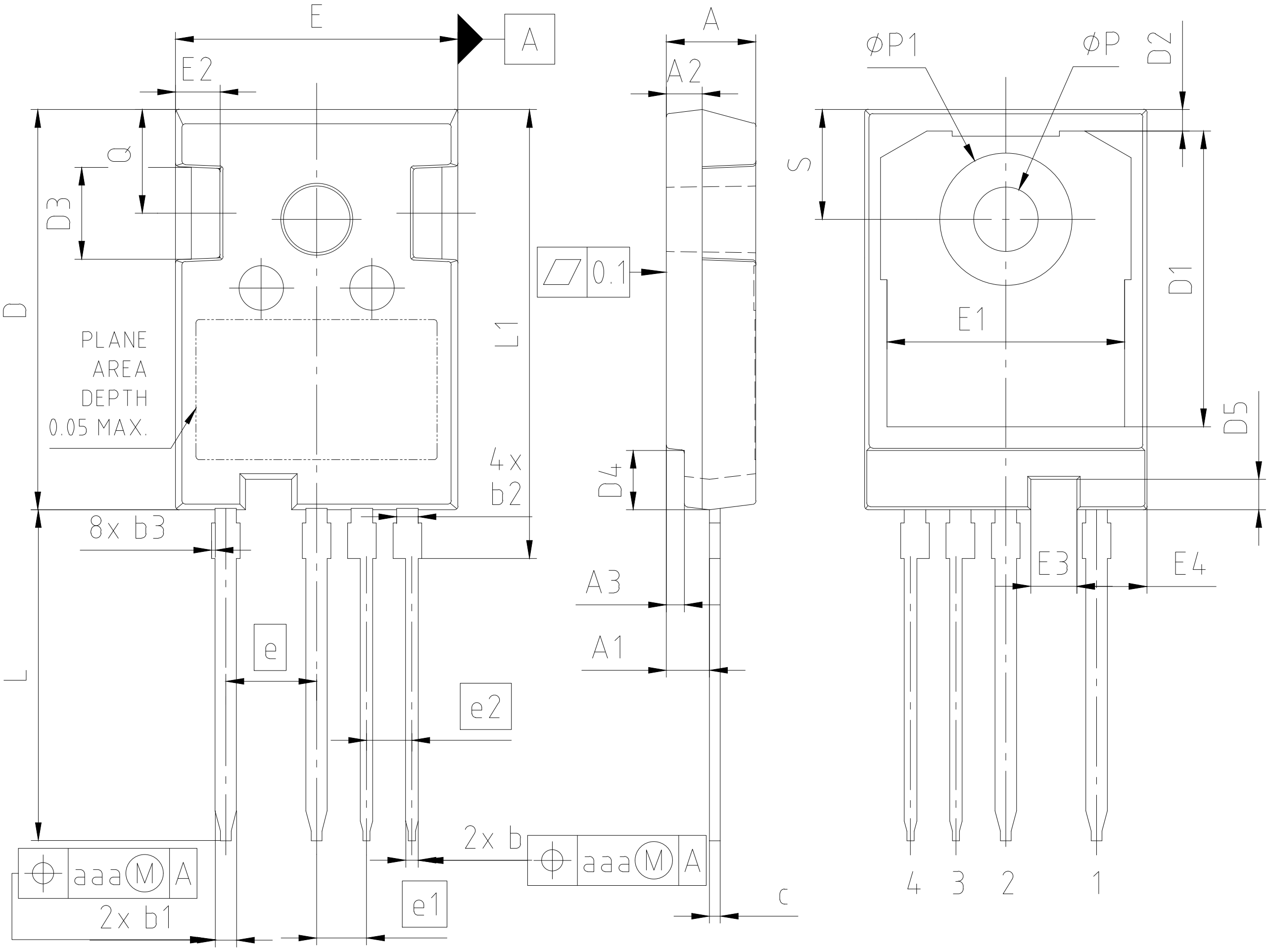
Typical diode current slope as a function of gate resistor

$di_F/dt = f(R_G)$

$V_R = 800$ V, $I_F = 40$ A



5 Package outlines



PACKAGE - GROUP NUMBER:	PG-TO247-4-U03				
DIMENSIONS	**MILLIMETERS**		**DIMENSIONS**	**MILLIMETERS**	
	MIN.	MAX.		MIN.	MAX.
A	4.90	5.10	**E**	15.70	15.90
A1	2.31	2.51	**E1**	13.10	13.50
A2	1.90	2.10	**E2**	2.40	2.60
A3	0.90	1.10	**E3**	2.48	2.68
b	0.66	0.79	**E4**	3.82	4.02
b1	1.16	1.29	**e**	5.08	
b2	1.16	1.29	**e1**	2.79	
b3		0.20	**e2**	2.54	
c	0.59	0.66	**N**	4	
D	22.30	22.50	**L**	18.40	18.70
D1	16.25	16.85	**L1**	24.97	25.27
D2	1.05	1.35	**øP**	3.50	3.70
D3	5.00	5.20	**øP1**		7.40
D4	3.22	3.42	**Q**	5.60	6.00
D5	1.60	1.80	**S**	6.00	6.30
			aaa	0.25	

NOTE: DIMENSIONS DO NOT INCLUDE MOLDFLASH; PROTRUSION OR GARE BURRS

Figure 1

6 Testing conditions

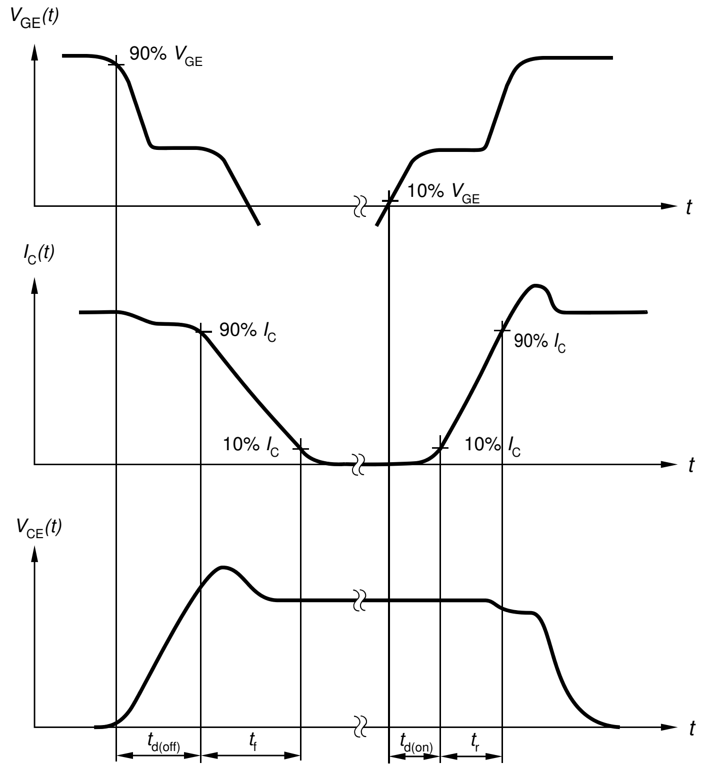


Figure A. **Definition of switching times**

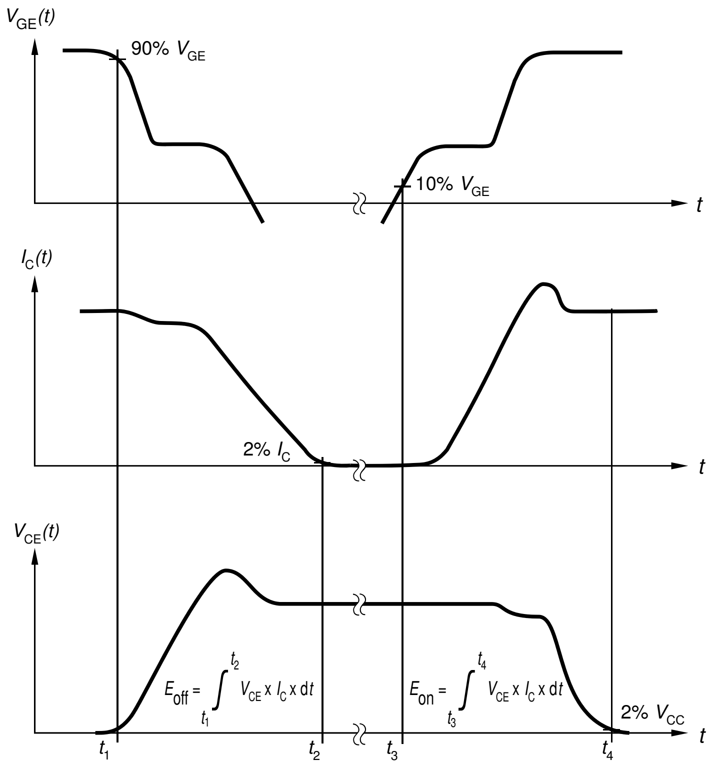


Figure B. **Definition of switching losses**

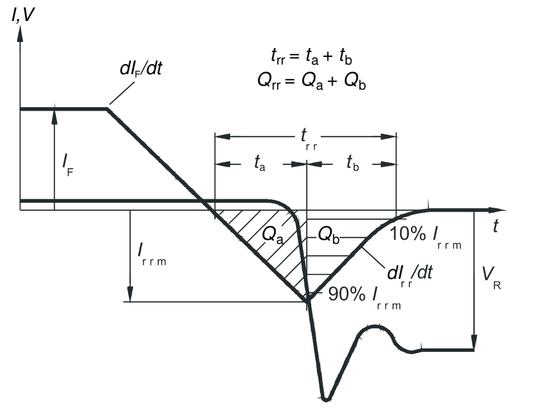


Figure C. **Definition of diode switching characteristics**

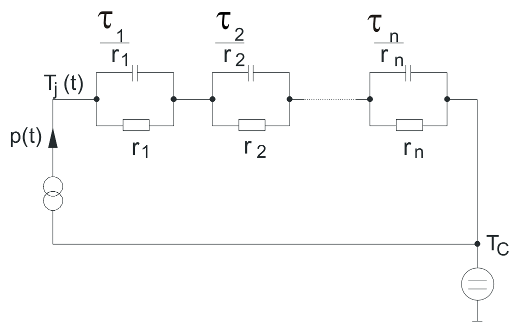


Figure D. **Thermal equivalent circuit**

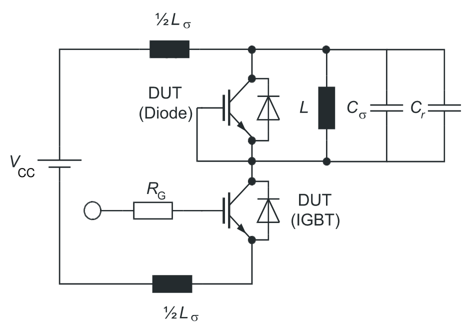


Figure E. **Dynamic test circuit**
Parasitic inductance L_σ,
parasitic capacitor C_σ,
relief capacitor C_r,
(only for ZVT switching)

Figure 2

Revision history

Document revision	Date of release	Description of changes
0.10	2025-02-07	Target datasheet
0.20	2026-03-18	Preliminary datasheet
1.00	2026-04-01	Final datasheet

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Edition 2026-04-01

Published by

Infineon Technologies AG

81726 Munich, Germany

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Document reference
IFX-ABM824-003