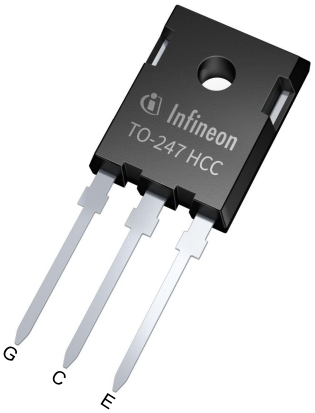
Final datasheet

TRENCHSTOP™ IGBT 7 PR7 Reverse Conducting IGBT for boost PFC stage with improved EMI characteristics offering the best-in-class performance for high power and high switching frequency applications

Features



- V_{CE} = 670 V
- I_C = 40 A
- Pin-to-pin creepage distance > 4.8 mm
- Pin-to-pin clearance distance > 3.4 mm
- Optimized monolithic diode for PFC applications
- Improved EMI behavior with lower dv/dt
- Very low V_{CEsat} = 1.4 V (typ.) at 25°C
- Stable temperature behavior
- Low temperature dependence of V_{CEsat} and E_{sw}
- 2 kV ESD HBM compliant
- Easy parallel switching capability based on positive temperature coefficient of V_{CEsat}
- Product spectrum and PSpice Models: http://www.infineon.com/igbt/

Lead-free
Green
Halogen-free
RoHS

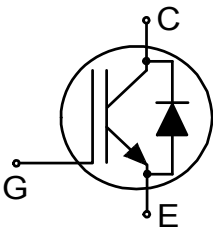
Potential applications

- Residential Aircon / Commercial Aircon
- Residential HVAC / Commercial HVAC

Product validation

- Qualified for industrial applications according to the relevant tests of JEDEC47/20/22

Description



Type	Package	Marking
IKWH40N67PR7	PG-TO247-3-U04	H40EPR7

Table of contents

1 Package

Table 1 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Internal emitter inductance measured 5 mm (0.197 in.) from case	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	$R_{th(j-c)}$			0.72	0.93	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		670	V
DC collector current, limited by T_{vjmax}	I_C		$T_c = 25$ °C	88	A
			$T_c = 100$ °C	54	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}			120	A
Turn-off safe operating area		$V_{CE} \leq 670$ V, $T_{vj} \leq 175$ °C		120	A
Gate-emitter voltage	V_{GE}			±20	V
Transient gate-emitter voltage	V_{GE}	$t_p \leq 0.5$ µs, $D < 0.001$		±30	V
Power dissipation	P_{tot}		$T_c = 25$ °C	208	W
			$T_c = 100$ °C	104	

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	$T_{vj} = 25$ °C		1.4	1.75	V
			$T_{vj} = 175$ °C		1.7		

(table continues...)

Table 3 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Gate-emitter threshold voltage	V_{GEth}	I_C = 0.228 mA, V_{CE} = V_{GE}		3.2	3.95	4.8	V
Zero gate-voltage collector current	I_{CES}	V_{CE} = 670 V, V_{GE} = 0 V	T_{vj} = 25 °C			40	mA
			T_{vj} = 175 °C		0.5		mA
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			69.6		S
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz			2283		pF
Output capacitance	C_{oes}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz			30.9		pF
Reverse transfer capacitance	C_{res}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz			11.6		pF
Gate charge	Q_G	V_{CC} = 520 V, I_C = 40 A, V_{GE} = 15 V			102		nC
Turn-on delay time	$t_{d(on)}$	V_{CC} = 400 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 9.8 Ω, $R_{G(off)}$ = 9.8 Ω	T_{vj} = 25 °C, I_C = 40 A		16		ns
			T_{vj} = 175 °C, I_C = 40 A		16		
Rise time (inductive load)	t_r	V_{CC} = 400 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 9.8 Ω, $R_{G(off)}$ = 9.8 Ω	T_{vj} = 25 °C, I_C = 40 A		15		ns
			T_{vj} = 175 °C, I_C = 40 A		14		
Turn-off delay time	$t_{d(off)}$	V_{CC} = 400 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 9.8 Ω, $R_{G(off)}$ = 9.8 Ω	T_{vj} = 25 °C, I_C = 40 A		146		ns
			T_{vj} = 175 °C, I_C = 40 A		170		
Fall time (inductive load)	t_f	V_{CC} = 400 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 9.8 Ω, $R_{G(off)}$ = 9.8 Ω	T_{vj} = 25 °C, I_C = 40 A		28		ns
			T_{vj} = 175 °C, I_C = 40 A		52		
Turn-on energy	E_{on}	V_{CC} = 400 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 9.8 Ω, $R_{G(off)}$ = 9.8 Ω	T_{vj} = 25 °C, I_C = 40 A		0.66		mJ
			T_{vj} = 175 °C, I_C = 40 A		1.19		
Turn-off energy	E_{off}	V_{CC} = 400 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 9.8 Ω, $R_{G(off)}$ = 9.8 Ω	T_{vj} = 25 °C, I_C = 40 A		0.4		mJ
			T_{vj} = 175 °C, I_C = 40 A		0.61		

(table continues...)

Table 3 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Total switching energy	E_{ts}	V_{CC} = 400 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 9.8 Ω, $R_{G(off)}$ = 9.8 Ω	T_{vj} = 25 °C, I_C = 40 A		1.06		mJ
			T_{vj} = 175 °C, I_C = 40 A		1.8		
Operating junction temperature	T_{vj}			-40		175	°C

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	670	V
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpulse}		5	A

Table 5 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
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, parasitic capacitor C_σ = 23 pF from Fig. C.

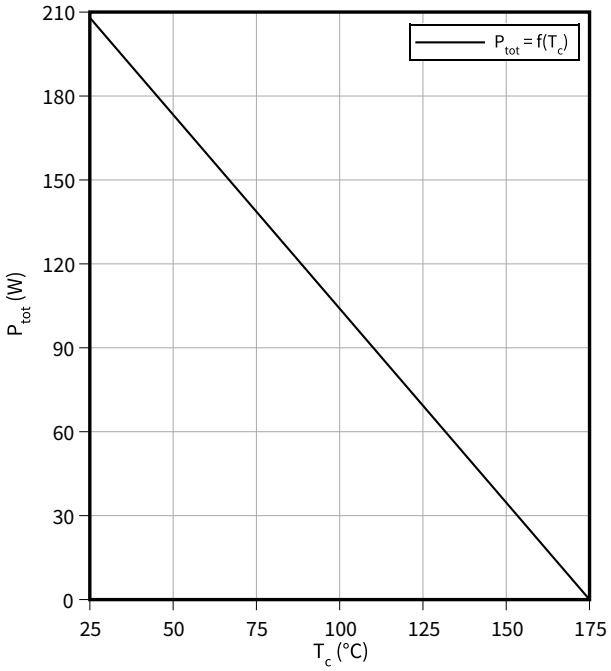
2nd device for EC7 Diode = IDWD40E65E7

4 Characteristics diagrams

Power dissipation as a function of case temperature

$P_{tot} = f(T_c)$

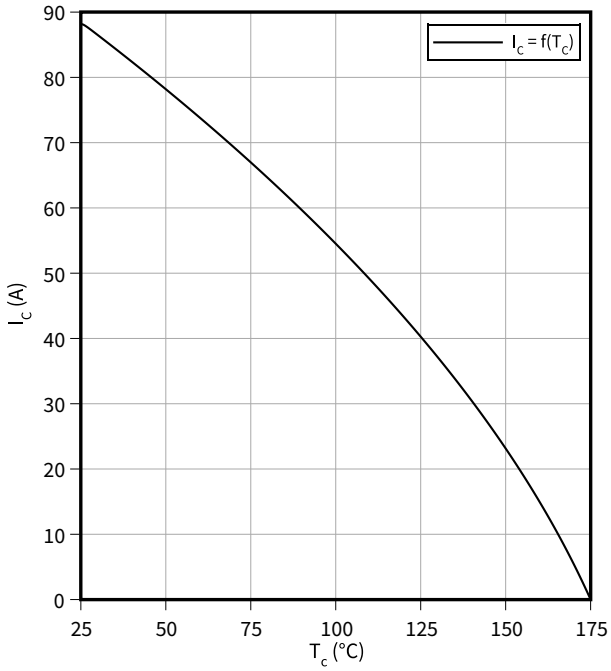
$T_{vj} \leq 175\ °C$



Collector current as a function of case temperature

$I_C = f(T_c)$

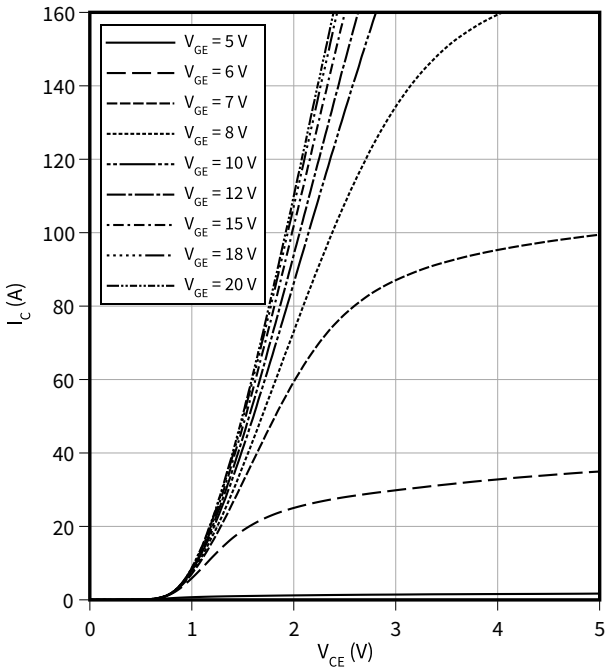
$T_{vj} \leq 175\ °C, V_{GE} \geq 15\ V$



Typical output characteristic

$I_C = f(V_{CE})$

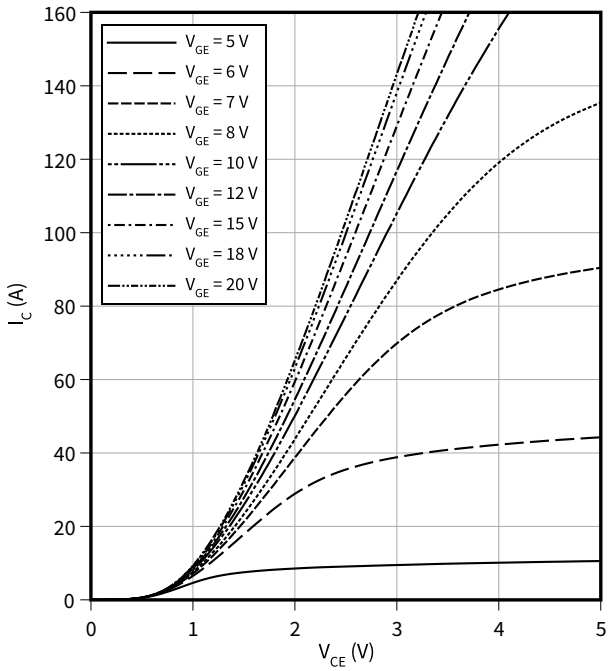
$T_{vj} = 25\ °C$



Typical output characteristic

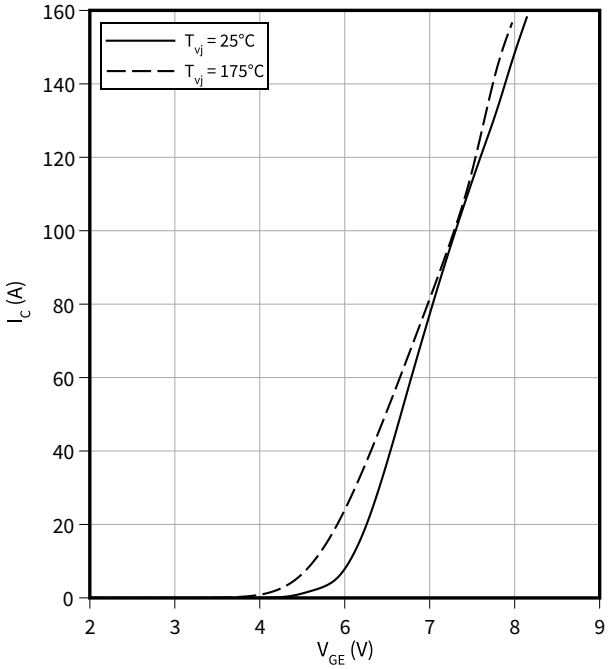
$I_C = f(V_{CE})$

$T_{vj} = 175\ °C$



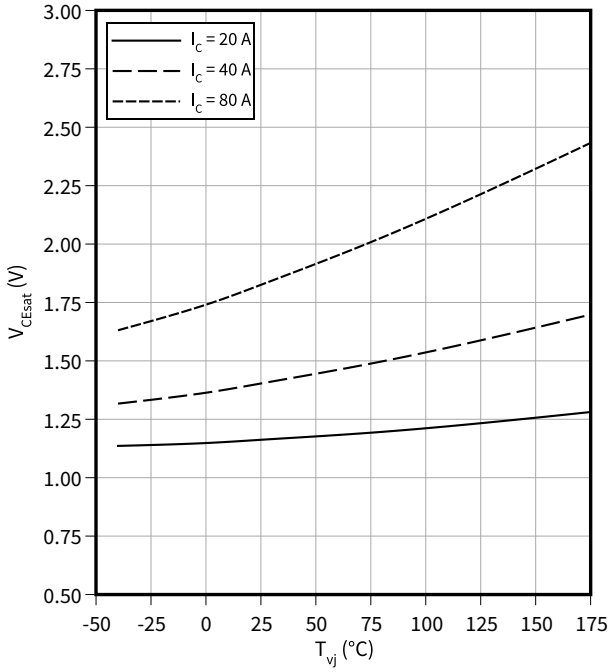
Typical transfer characteristic

$I_C = f(V_{GE})$
$V_{CE} = 20$ V



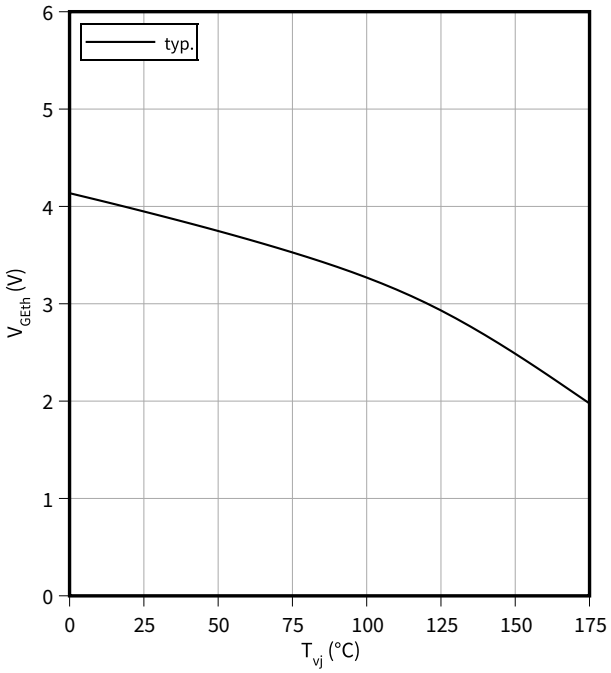
Typical collector-emitter saturation voltage as a function of junction temperature

$V_{CEsat} = f(T_{vj})$
$V_{GE} = 15$ V



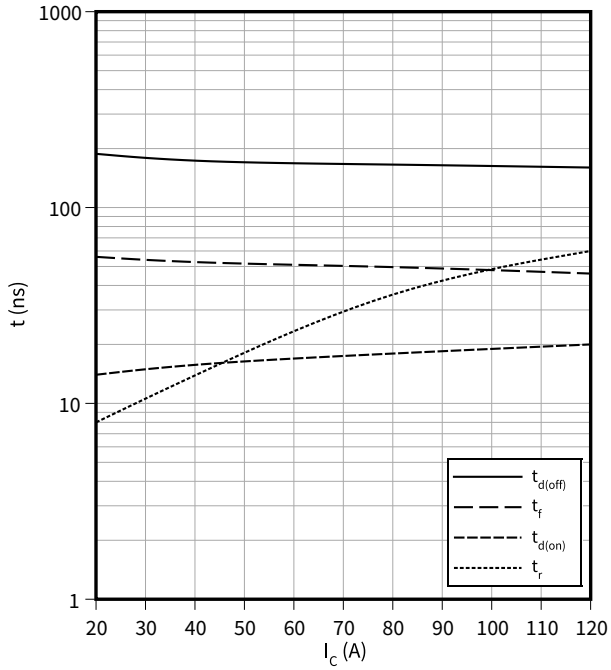
Gate-emitter threshold voltage as a function of junction temperature

$V_{GEth} = f(T_{vj})$
$I_C = 0.228$ mA



Typical switching times as a function of collector current

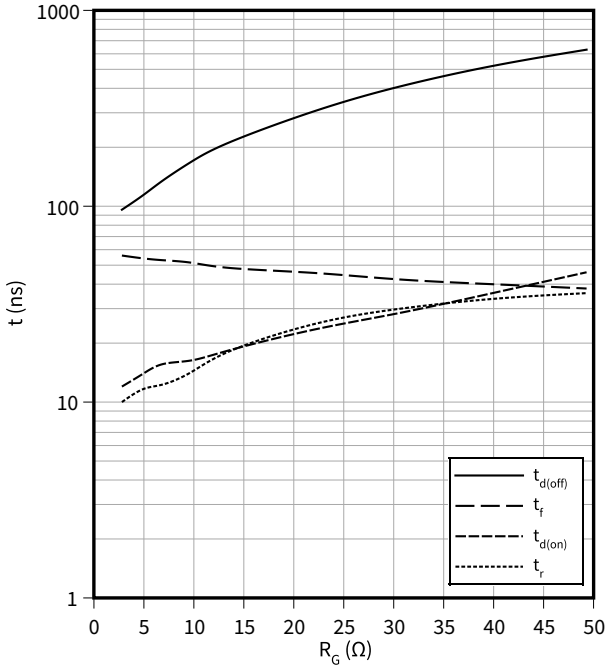
$t = f(I_C)$
$V_{CC} = 400$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 9.8\ \Omega$



Typical switching times as a function of gate resistor

$t = f(R_G)$

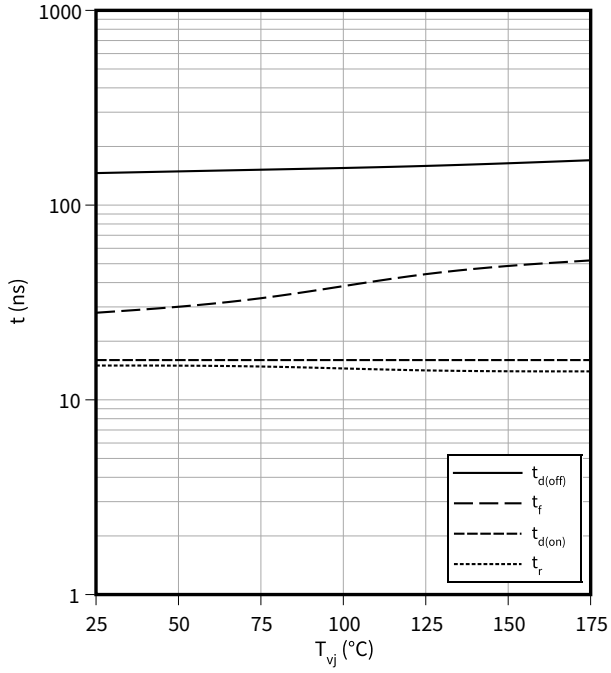
$I_C = 40\ A$, $V_{CC} = 400\ V$, $T_{vj} = 175\ °C$, $V_{GE} = 0/15\ V$



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

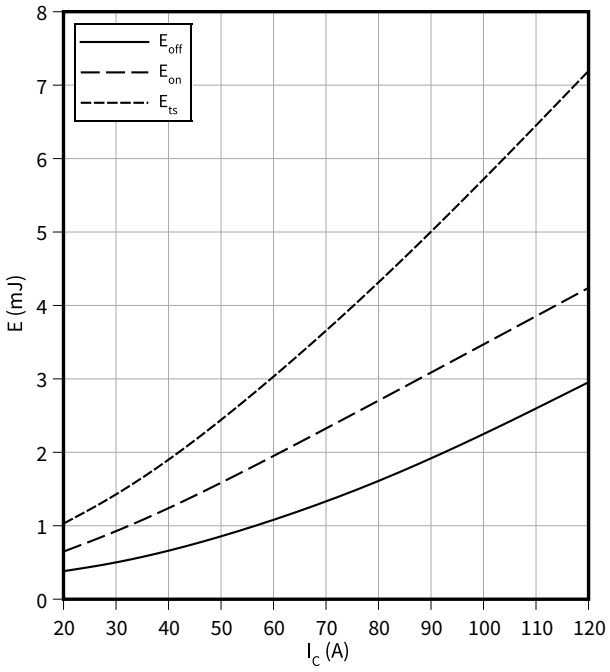
$I_C = 40\ A$, $V_{CC} = 400\ V$, $V_{GE} = 0/15\ V$, $R_G = 9.8\ Ω$



Typical switching energy losses as a function of collector current

$E = f(I_C)$

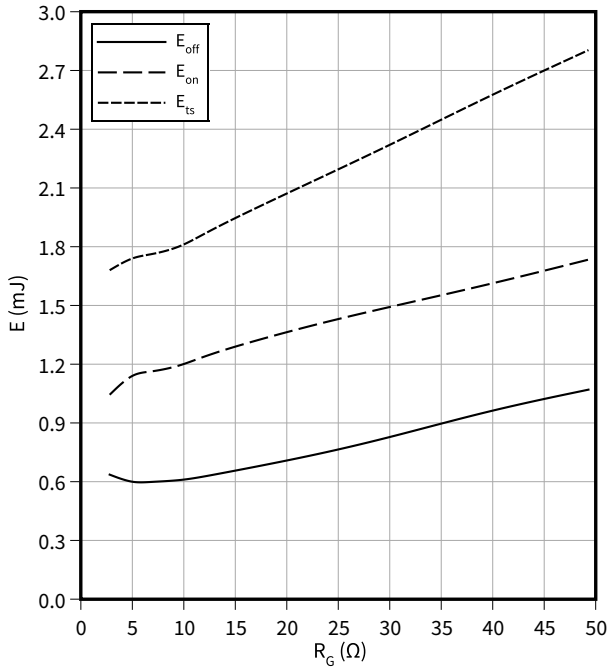
$V_{CC} = 400\ V$, $T_{vj} = 175\ °C$, $V_{GE} = 0/15\ V$, $R_G = 9.8\ Ω$



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

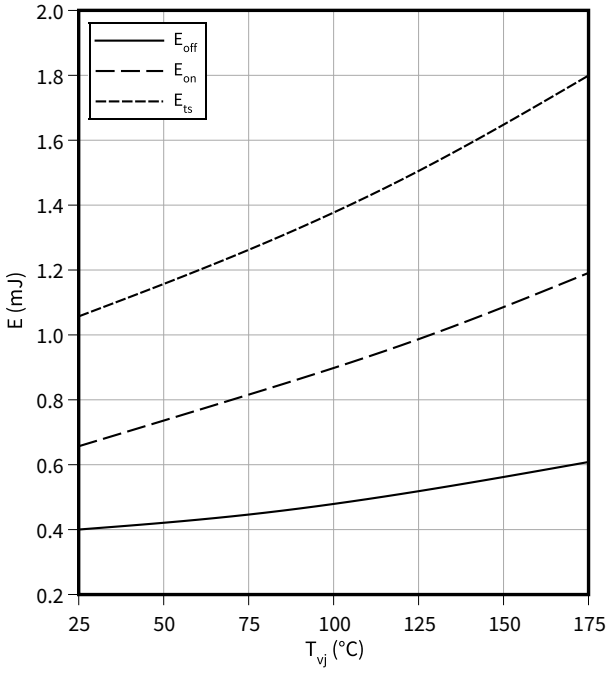
$I_C = 40\ A$, $V_{CC} = 400\ V$, $T_{vj} = 175\ °C$, $V_{GE} = 0/15\ V$



Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

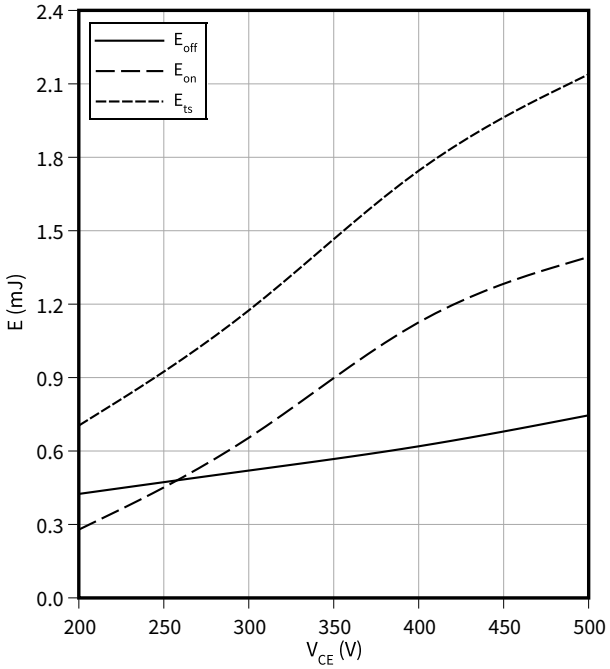
$I_C = 40\ A$, $V_{CC} = 400\ V$, $V_{GE} = 0/15\ V$, $R_G = 9.8\ \Omega$



Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$

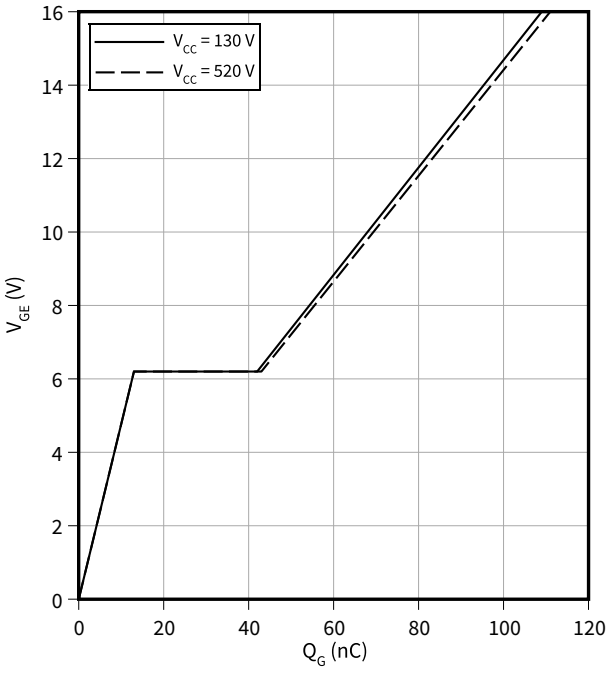
$I_C = 40\ A$, $T_{vj} = 175\ °C$, $V_{GE} = 0/15\ V$, $R_G = 9.8\ \Omega$



Typical gate charge

$V_{GE} = f(Q_G)$

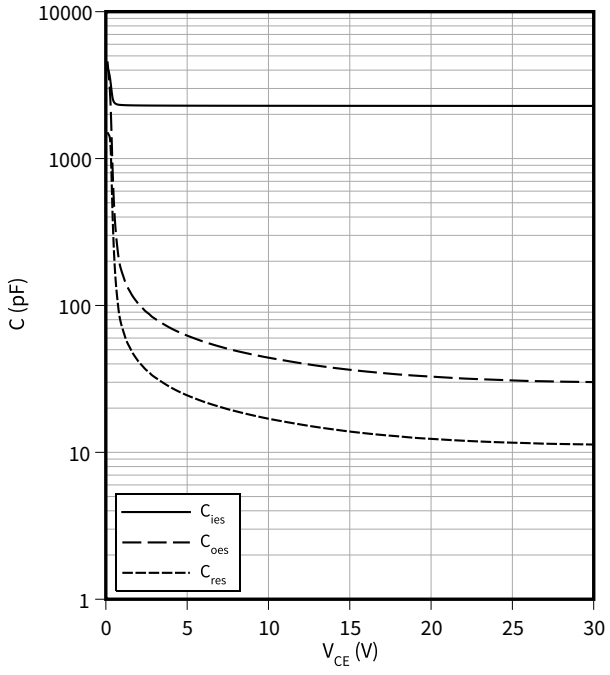
$I_C = 40\ A$



Typical capacitance as a function of collector-emitter voltage

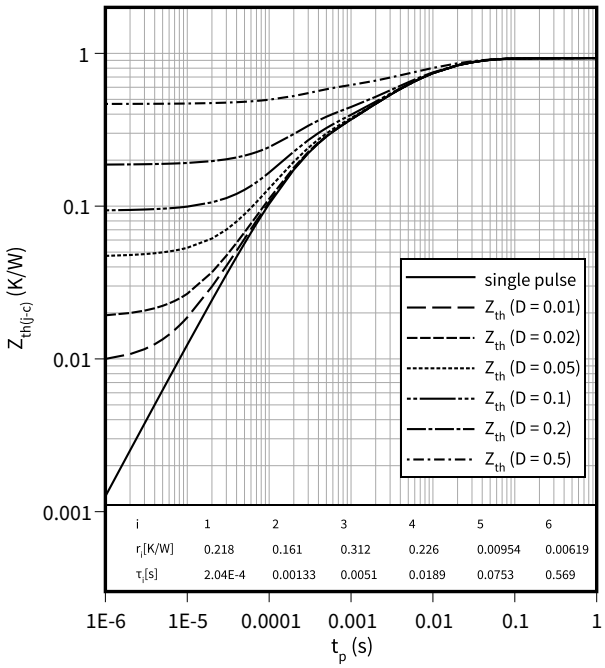
$C = f(V_{CE})$

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

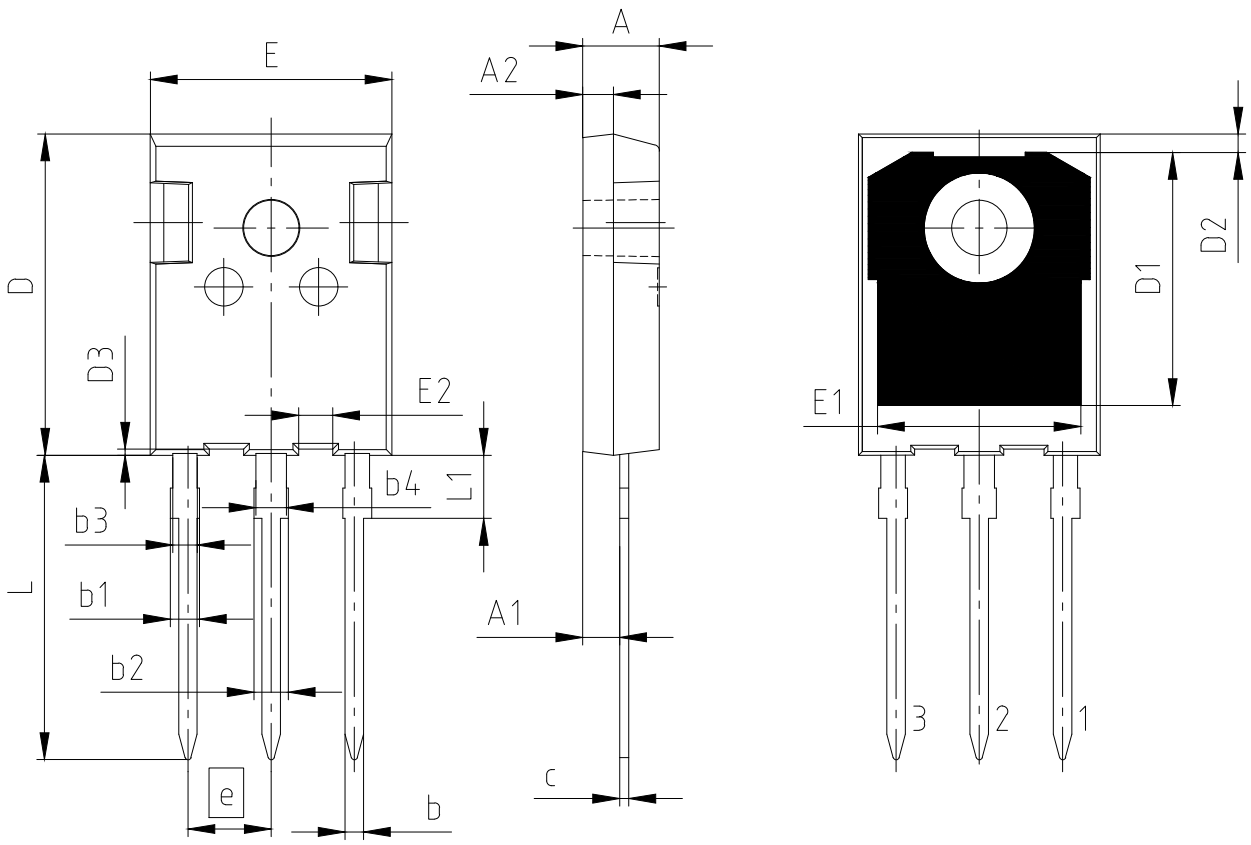


IGBT transient thermal impedance as a function of pulse width

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



5 Package outlines



PACKAGE - GROUP NUMBER:	PG-TO247-3-U04	
DIMENSIONS	**MILLIMETERS**	
	MIN.	MAX.
A	4.90	5.10
A1	2.31	2.51
A2	1.90	2.10
b	1.16	1.26
b1		1.90
b2		2.30
b3	1.55	1.65
b4	1.96	2.06
c	0.59	0.66
D	20.90	21.10
D1	16.25	16.85
D2	1.05	1.35
D3	0.55	0.65
E	15.70	15.90
E1	13.10	13.50
E2	2.14	2.34
e	5.44	
N	3	
L	19.80	20.10
L1	3.95	4.30

Figure 1

6 Testing conditions

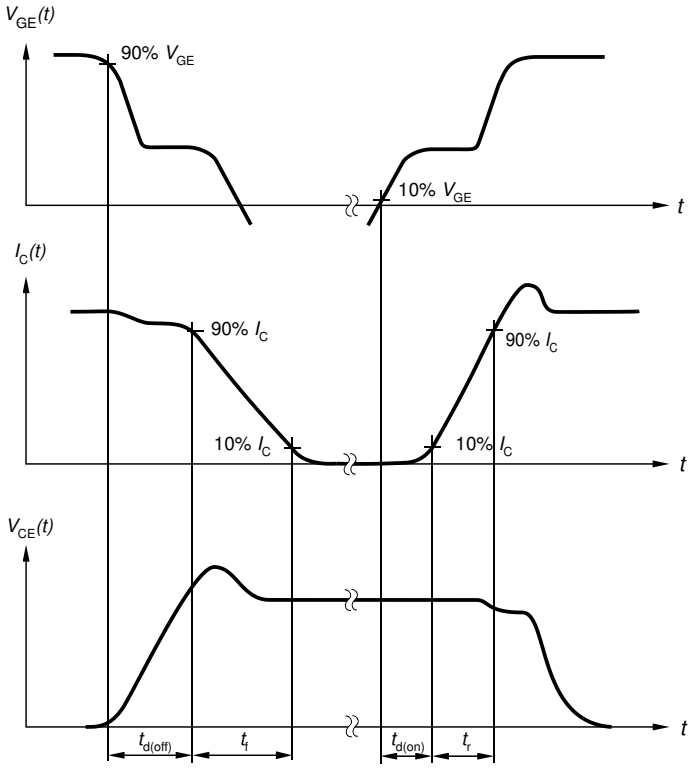


Figure A. **Definition of switching times**

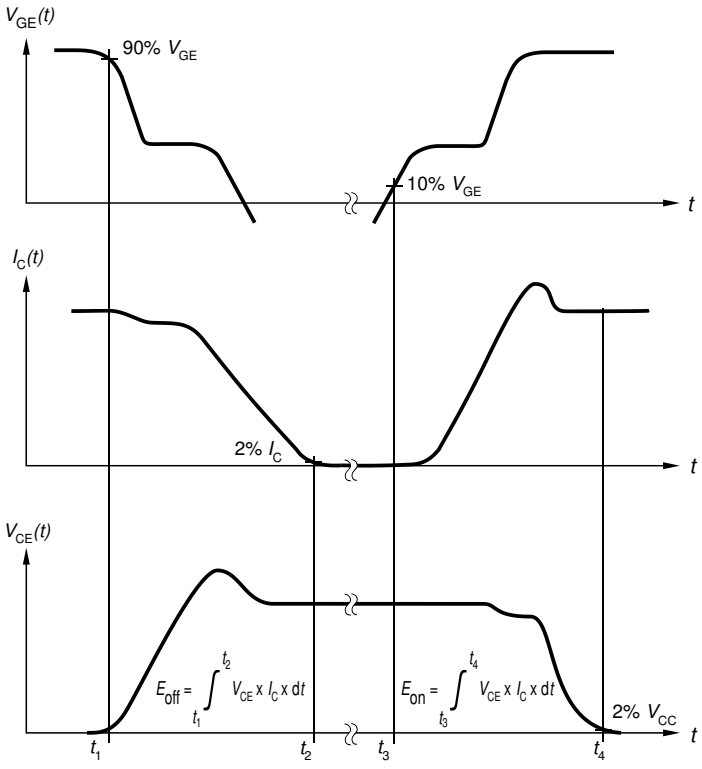


Figure B. **Definition of switching losses**

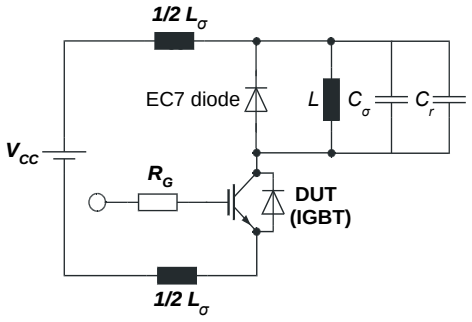


Figure C. **Dynamic test circuit**
Parasitic inductance L_σ,
parasitic capacitor C_σ,
relief capacitor C_r,
(only for ZVT switching)

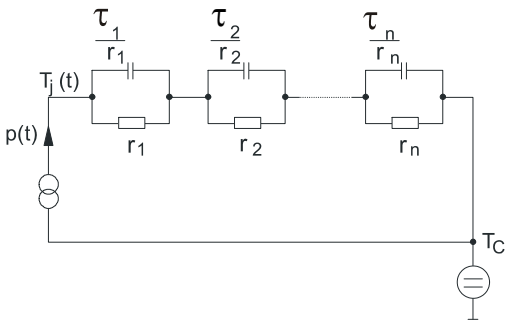


Figure D. **Termal equivalent circuit**

Figure 2

Revision history

Document revision	Date of release	Description of changes
0.10	2024-08-13	Preliminary datasheet
1.00	2024-09-23	Final datasheet

Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

Edition 2024-09-23

Published by

Infineon Technologies AG

81726 Munich, Germany

Do you have a question about any aspect of this document?

Email: erratum@infineon.com

Document reference
IFX-ABJ794-002

Important notice

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenheitsgarantie").

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

Please note that this product is not qualified according to the AEC Q100 or AEC Q101 documents of the Automotive Electronics Council.

Warnings

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.