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 = 60 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

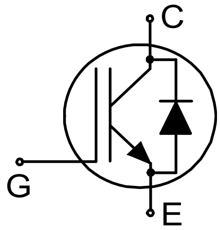
Potential applications

- 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
IKWH60N67PR7	PG-TO247-3-U04	H60EPR7

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	$R_{th(j-c)}$			0.53	0.69	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	122	A
			$T_c = 100$ °C	75	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}			180	A
Turn-off safe operating area		$V_{CE} \leq 670$ V, $T_{vj} \leq 175$ °C		180	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	283	W
			$T_c = 100$ °C	142	

Table 3 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	V_{CEsat}	$I_C = 60$ 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 = 0.342 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		5		mA
Gate-emitter leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = 20 V				100	nA
Transconductance	g_{fs}	I_C = 60 A, V_{CE} = 20 V			91.9		S
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz			3311		pF
Output capacitance	C_{oes}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz			44		pF
Reverse transfer capacitance	C_{res}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz			17.2		pF
Gate charge	Q_G	V_{CC} = 520 V, I_C = 60 A, V_{GE} = 15 V			148		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 = 60 A		20		ns
			T_{vj} = 175 °C, I_C = 60 A		18		
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 = 60 A		24		ns
			T_{vj} = 175 °C, I_C = 60 A		22		
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 = 60 A		208		ns
			T_{vj} = 175 °C, I_C = 60 A		234		
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 = 60 A		36		ns
			T_{vj} = 175 °C, I_C = 60 A		39		
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 = 60 A		1.28		mJ
			T_{vj} = 175 °C, I_C = 60 A		1.83		
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 = 60 A		0.78		mJ
			T_{vj} = 175 °C, I_C = 60 A		0.95		

(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 = 60 A		2.06		mJ
			T_{vj} = 175 °C, I_C = 60 A		2.79		
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.*

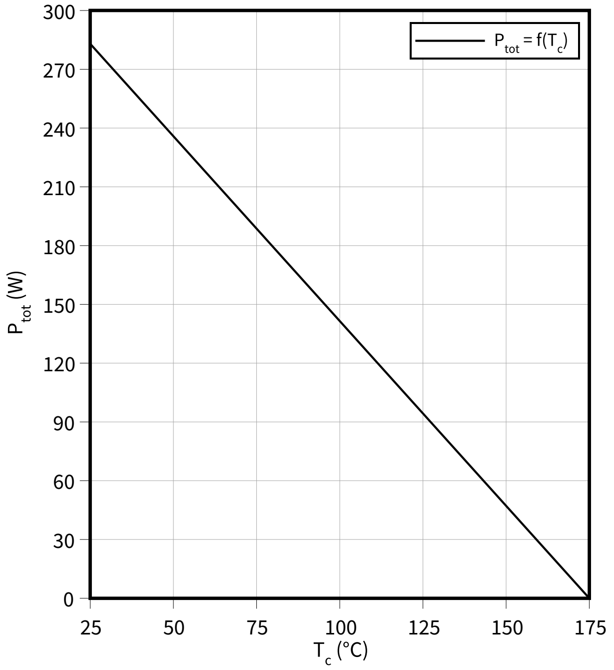
Electrical Characteristic, at T_{vj} = 25°C, unless otherwise specified.

Dynamic test circuit, parasitic inductance L_σ = 30 nH, parasitic capacitor C_σ = 23 pF from Fig. C.

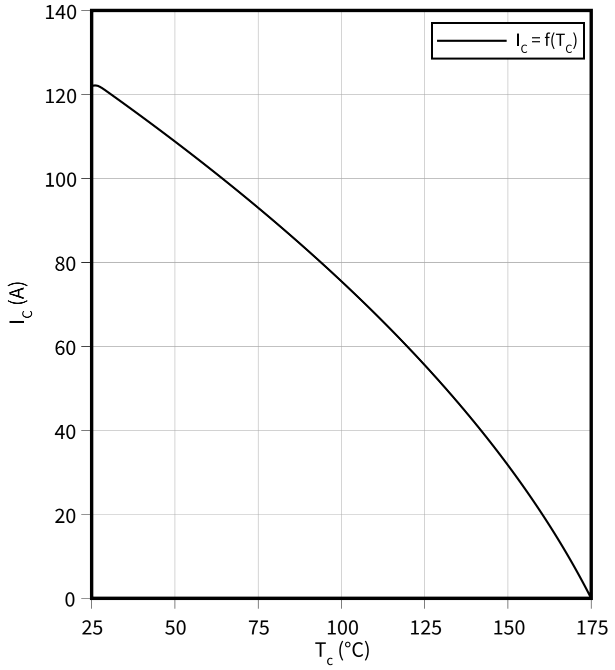
2nd device for EC7 Diode = IDWD60E65E7

4 Characteristics diagrams

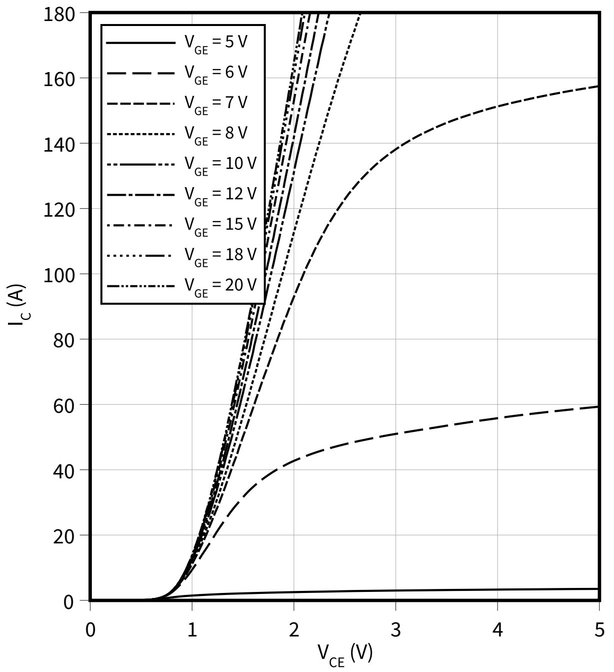
Power dissipation as a function of case temperature
$P_{tot} = f(T_c)$
$T_{vj} \leq 175$ °C



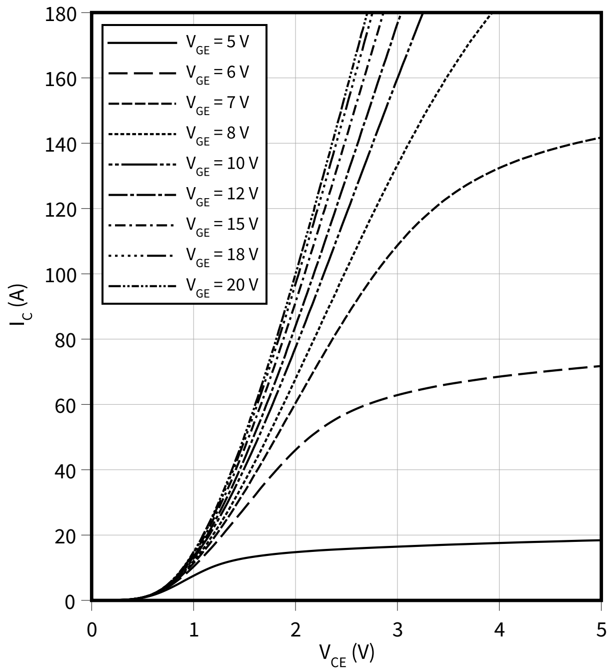
Collector current as a function of case temperature
$I_C = f(T_c)$
$T_{vj} \leq 175$ °C, $V_{GE} \geq 15$ V



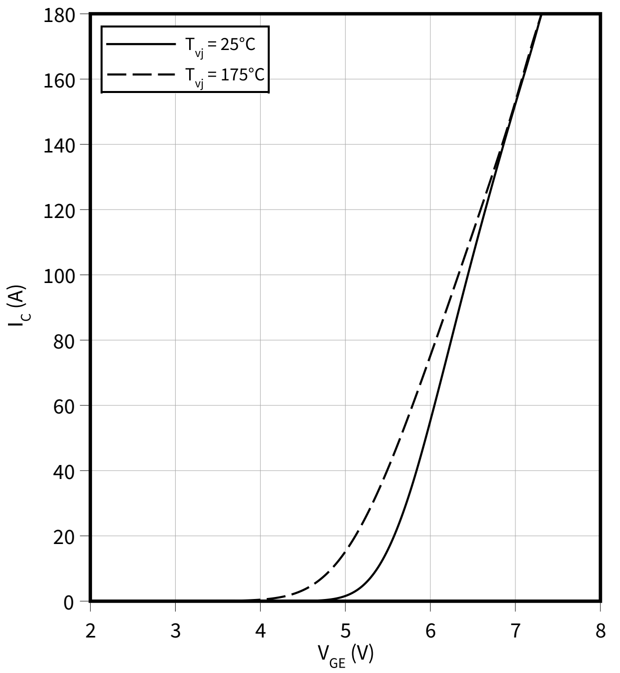
Typical output characteristic
$I_C = f(V_{CE})$
$T_{vj} = 25$ °C



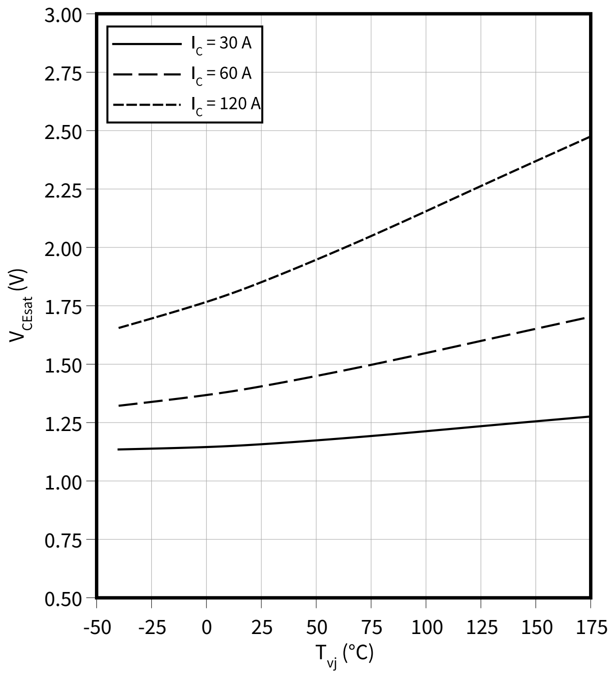
Typical output characteristic
$I_C = f(V_{CE})$
$T_{vj} = 175$ °C



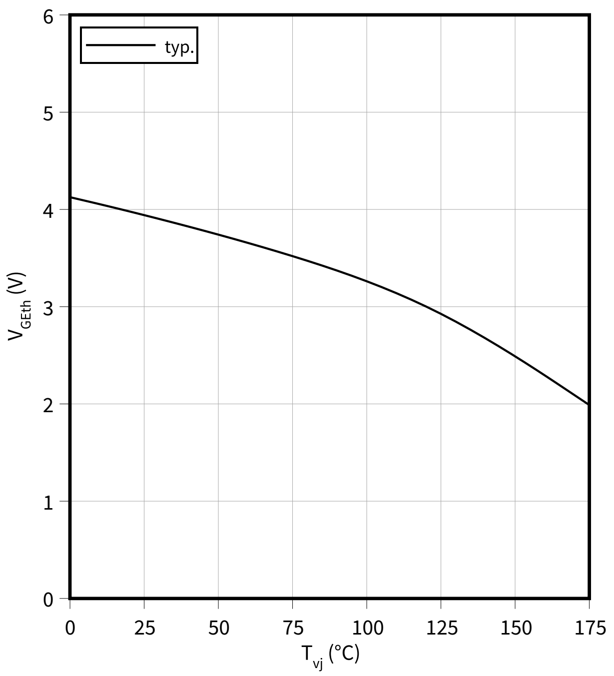
Typical transfer characteristic
$I_C = f(V_{GE})$
$V_{CE} = 20$ V



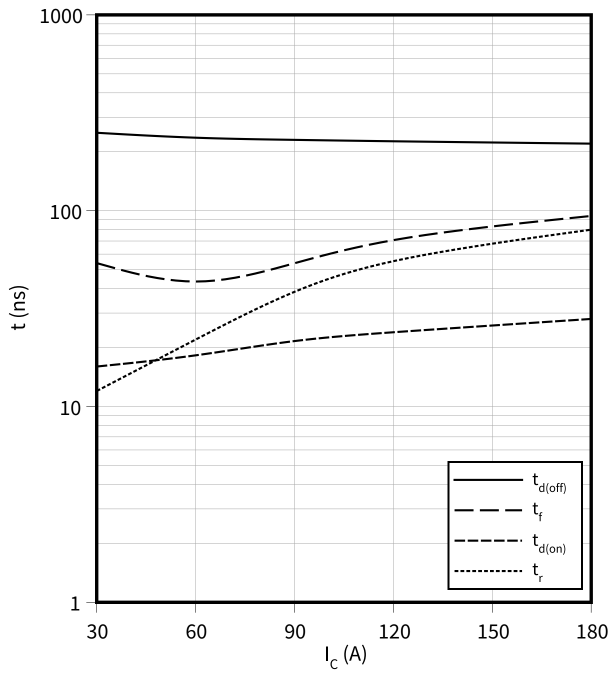
Typical collector-emitter saturation voltage as a function of junction temperature
$V_{CEsat} = f(T_{vj})$
$V_{GE} = 15$ V



Gate-emitter threshold voltage as a function of junction temperature
$V_{GEth} = f(T_{vj})$
$I_C = 0.342$ mA



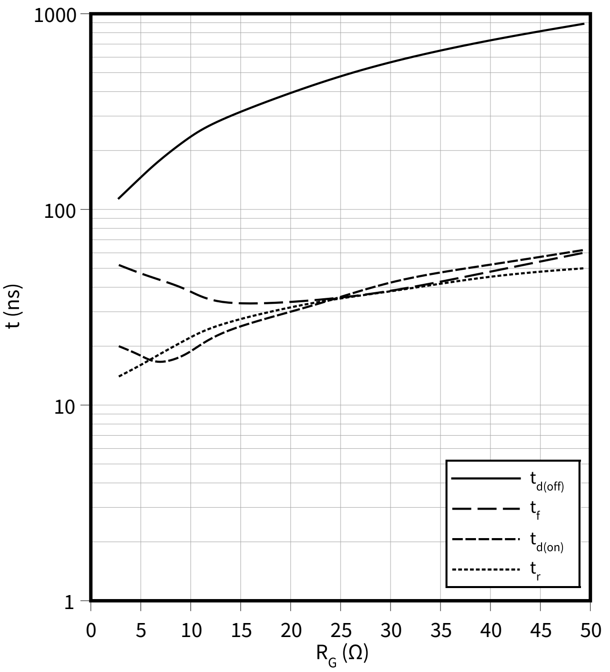
Typical switching times as a function of collector current
$t = f(I_C)$
$V_{CC} = 400$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 9.8\ \Omega$



Typical switching times as a function of gate resistor

t = f(R_G)

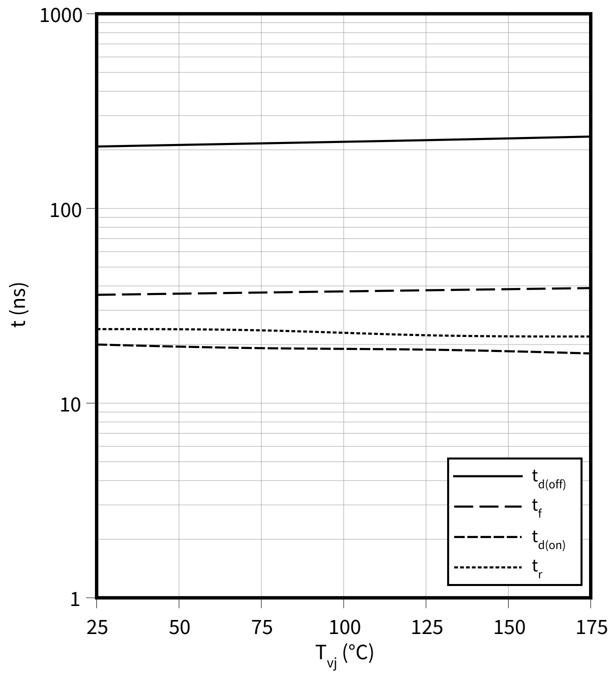
I_C = 60 A, V_{CC} = 400 V, T_{vj} = 175 °C, V_{GE} = 0/15 V



Typical switching times as a function of junction temperature

t = f(T_{vj})

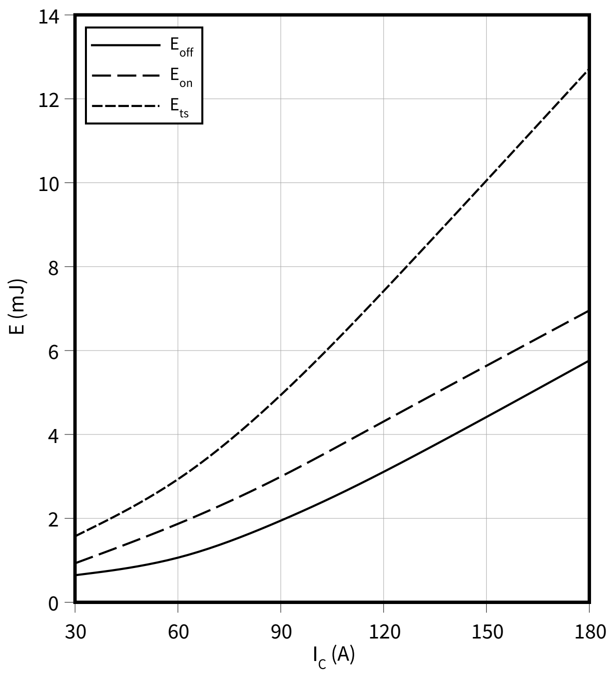
I_C = 60 A, V_{CC} = 400 V, V_{GE} = 0/15 V, R_G = 9.8 Ω



Typical switching energy losses as a function of collector current

E = f(I_C)

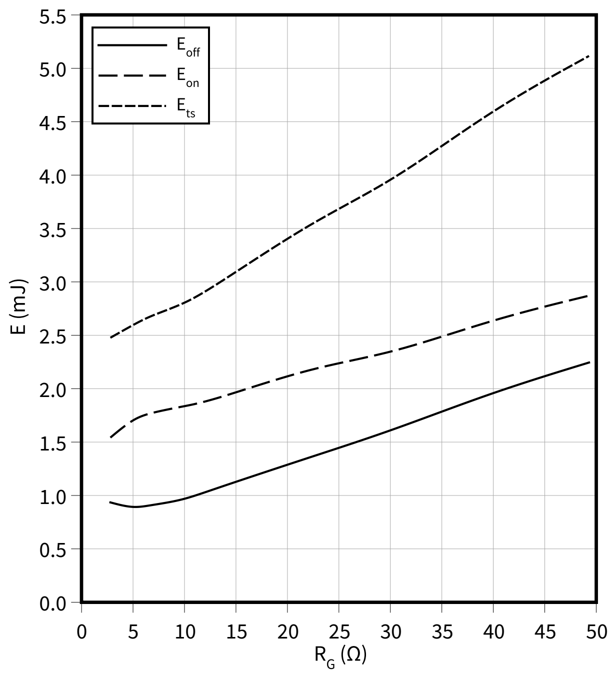
V_{CC} = 400 V, T_{vj} = 175 °C, V_{GE} = 0/15 V, R_G = 9.8 Ω

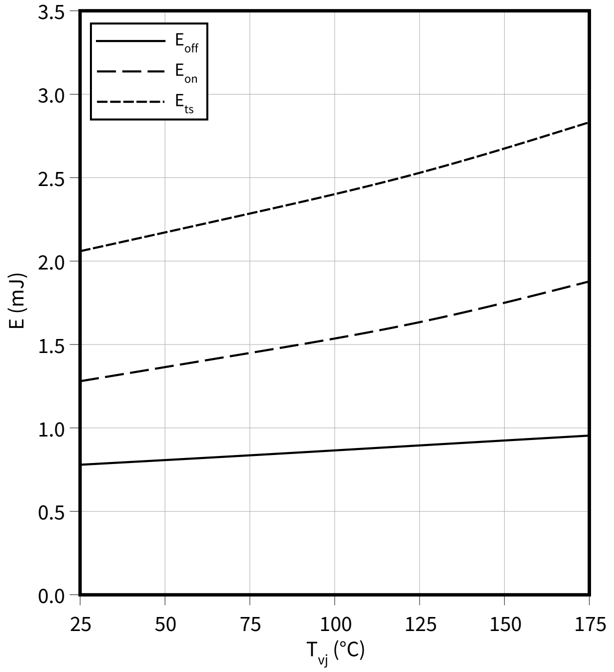
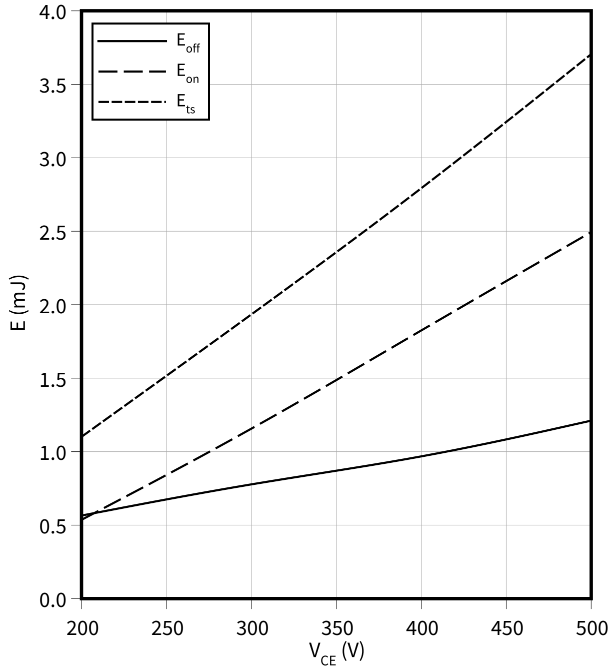
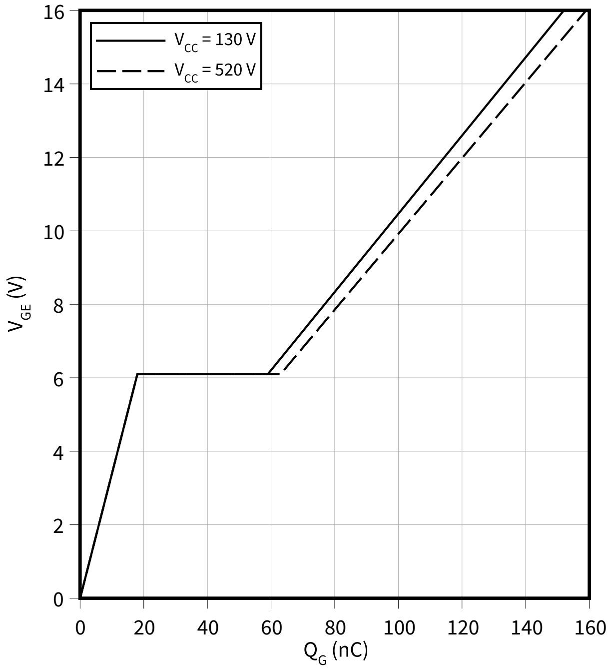
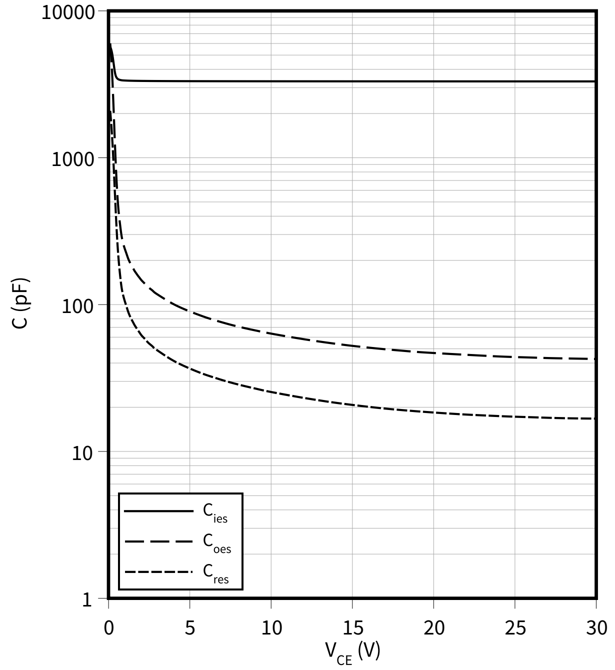


Typical switching energy losses as a function of gate resistor

E = f(R_G)

I_C = 60 A, V_{CC} = 400 V, T_{vj} = 175 °C, V_{GE} = 0/15 V

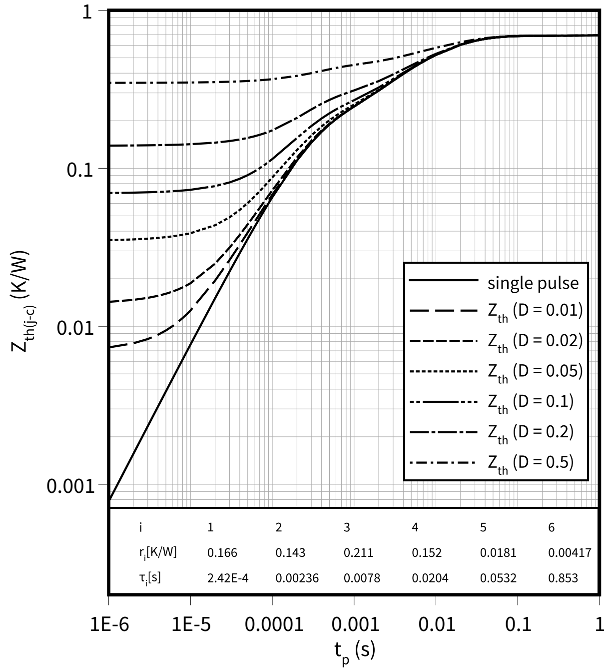


Typical switching energy losses as a function of junction temperature	Typical switching energy losses as a function of collector emitter voltage
$E = f(T_{vj})$	$E = f(V_{CE})$
$I_C = 60$ A, $V_{CC} = 400$ V, $V_{GE} = 0/15$ V, $R_G = 9.8\ \Omega$	$I_C = 60$ A, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 9.8\ \Omega$
	
Typical gate charge	**Typical capacitance as a function of collector-emitter voltage**
$V_{GE} = f(Q_G)$	$C = f(V_{CE})$
$I_C = 60$ A	f = 100 kHz, $V_{GE} = 0$ V
	

IGBT transient thermal impedance as a function of pulse width

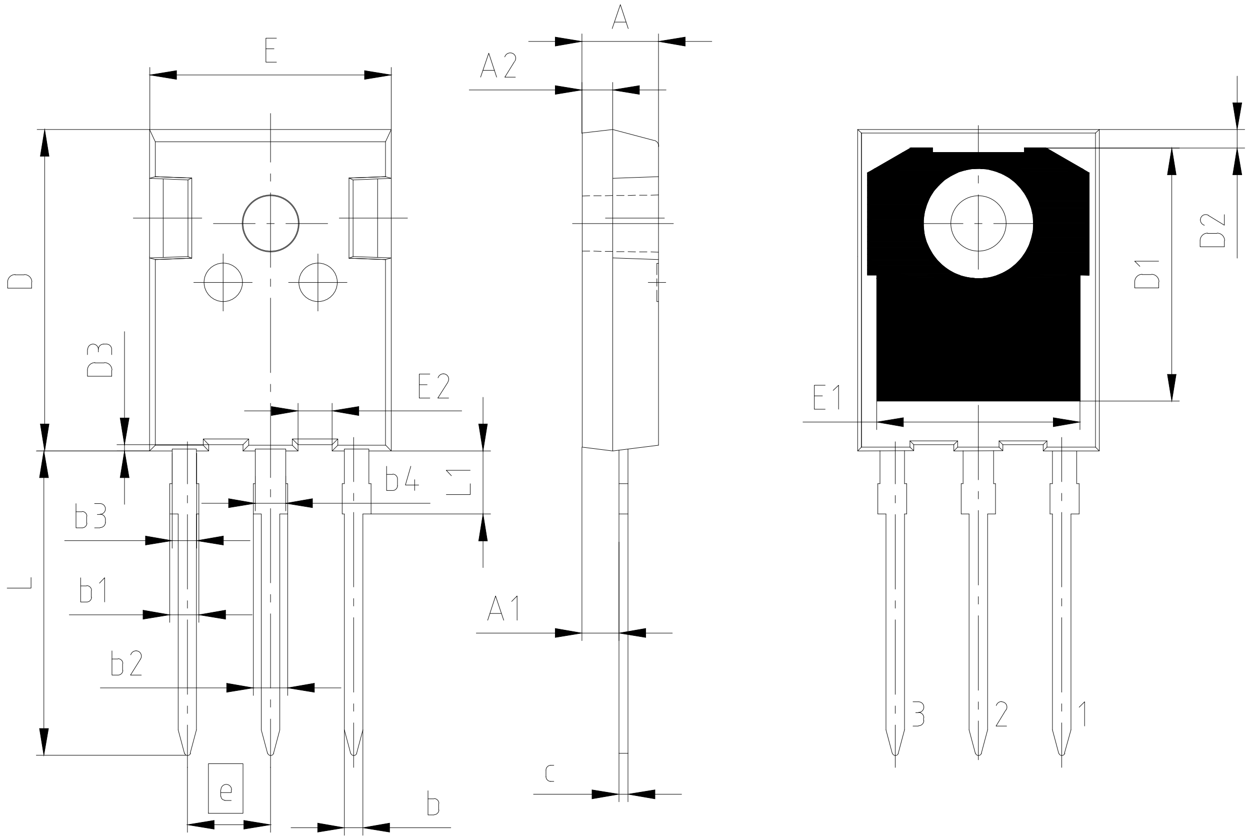
$Z_{th(j-c)} = f(t_p)$

$D = t_p/T$



i	1	2	3	4	5	6
r_i[K/W]	0.166	0.143	0.211	0.152	0.0181	0.00417
τ_i[s]	2.42E-4	0.00236	0.0078	0.0204	0.0532	0.853

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

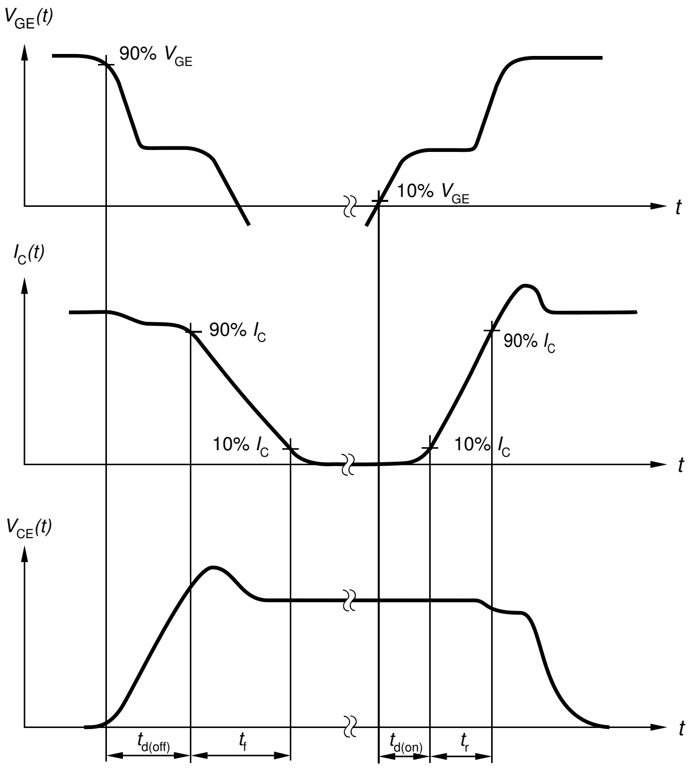


Figure A. **Definition of switching times**

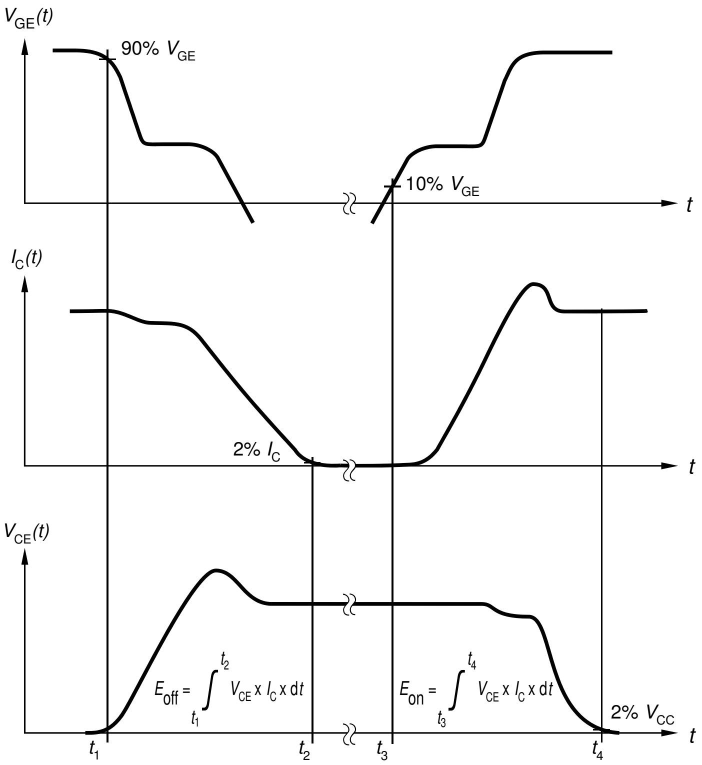


Figure B. **Definition of switching losses**

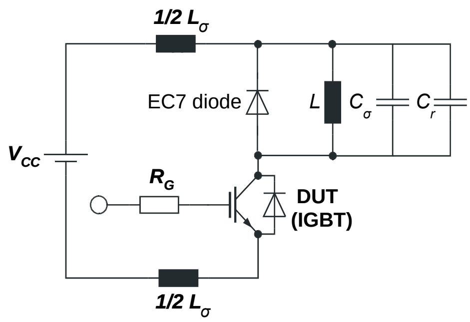


Figure C. **Dynamic test circuit**

Parasitic inductance L_{σ},
parasitic capacitor C_{σ},
relief capacitor C_r,
(only for ZVT switching)

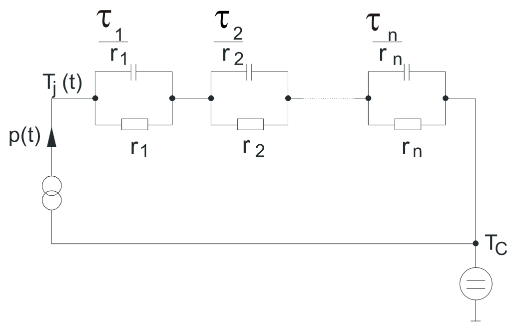


Figure D. **Termal equivalent circuit**

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

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Edition 2024-09-23

Published by

Infineon Technologies AG

81726 Munich, Germany

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Document reference
IFX-ABJ849-002