

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

- $V_{CE} = 670\text{ V}$
- $I_C = 40\text{ A}$
- 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 $V_{CEsat} = 1.4\text{ V}$ (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/>

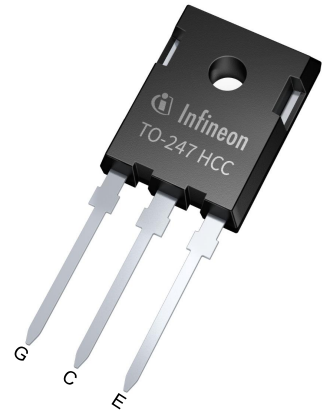
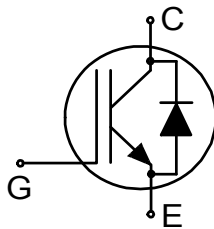
Potential applications

- 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

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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}	$T_{vj} \geq 25\text{ °C}$	670	V	
DC collector current, limited by T_{vjmax}	I_C		$T_c = 25\text{ °C}$	88	A
			$T_c = 100\text{ °C}$	54	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}		120	A	
Turn-off safe operating area		$V_{CE} \leq 670\text{ V}, T_{vj} \leq 175\text{ °C}$	120	A	
Gate-emitter voltage	V_{GE}		± 20	V	
Transient gate-emitter voltage	V_{GE}	$t_p \leq 0.5\ \mu\text{s}, D < 0.001$	± 30	V	
Power dissipation	P_{tot}		$T_c = 25\text{ °C}$	208	W
			$T_c = 100\text{ °C}$	104	

Table 3 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit	
			Min.	Typ.	Max.		
Collector-emitter saturation voltage	V_{CEsat}	$I_C = 40\text{ A}$		$T_{vj} = 25\text{ °C}$	1.4	1.75	V
				$T_{vj} = 175\text{ °C}$	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}	$I_C = 0.228 \text{ mA}, V_{CE} = V_{GE}$	3.2	3.95	4.8	V
Zero gate-voltage collector current	I_{CES}	$V_{CE} = 670 \text{ V}, V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$		40	mA
			$T_{vj} = 175 \text{ }^\circ\text{C}$		0.5	mA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = 20 \text{ V}$			100	nA
Transconductance	g_{fs}	$I_C = 40 \text{ A}, V_{CE} = 20 \text{ V}$		69.6		S
Input capacitance	C_{ies}	$V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}, f = 100 \text{ kHz}$		2283		pF
Output capacitance	C_{oes}	$V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}, f = 100 \text{ kHz}$		30.9		pF
Reverse transfer capacitance	C_{res}	$V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}, f = 100 \text{ kHz}$		11.6		pF
Gate charge	Q_G	$V_{CC} = 520 \text{ V}, I_C = 40 \text{ A}, V_{GE} = 15 \text{ V}$		102		nC
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V}, R_{G(on)} = 9.8 \text{ } \Omega, R_{G(off)} = 9.8 \text{ } \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}, I_C = 40 \text{ A}$		16	ns
			$T_{vj} = 175 \text{ }^\circ\text{C}, I_C = 40 \text{ A}$		16	
Rise time (inductive load)	t_r	$V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V}, R_{G(on)} = 9.8 \text{ } \Omega, R_{G(off)} = 9.8 \text{ } \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}, I_C = 40 \text{ A}$		15	ns
			$T_{vj} = 175 \text{ }^\circ\text{C}, I_C = 40 \text{ A}$		14	
Turn-off delay time	$t_{d(off)}$	$V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V}, R_{G(on)} = 9.8 \text{ } \Omega, R_{G(off)} = 9.8 \text{ } \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}, I_C = 40 \text{ A}$		146	ns
			$T_{vj} = 175 \text{ }^\circ\text{C}, I_C = 40 \text{ A}$		170	
Fall time (inductive load)	t_f	$V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V}, R_{G(on)} = 9.8 \text{ } \Omega, R_{G(off)} = 9.8 \text{ } \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}, I_C = 40 \text{ A}$		28	ns
			$T_{vj} = 175 \text{ }^\circ\text{C}, I_C = 40 \text{ A}$		52	
Turn-on energy	E_{on}	$V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V}, R_{G(on)} = 9.8 \text{ } \Omega, R_{G(off)} = 9.8 \text{ } \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}, I_C = 40 \text{ A}$		0.66	mJ
			$T_{vj} = 175 \text{ }^\circ\text{C}, I_C = 40 \text{ A}$		1.19	
Turn-off energy	E_{off}	$V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V}, R_{G(on)} = 9.8 \text{ } \Omega, R_{G(off)} = 9.8 \text{ } \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}, I_C = 40 \text{ A}$		0.4	mJ
			$T_{vj} = 175 \text{ }^\circ\text{C}, I_C = 40 \text{ A}$		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}	$V_{CC} = 400\text{ V}, V_{GE} = 0/15\text{ V},$ $R_{G(on)} = 9.8\ \Omega,$ $R_{G(off)} = 9.8\ \Omega$	$T_{vj} = 25\text{ °C},$ $I_C = 40\text{ A}$		1.06		mJ
			$T_{vj} = 175\text{ °C},$ $I_C = 40\text{ A}$		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}	$T_{vj} \geq 25\text{ °C}$	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 $T_{vj} = 25\text{ °C}$, unless otherwise specified.

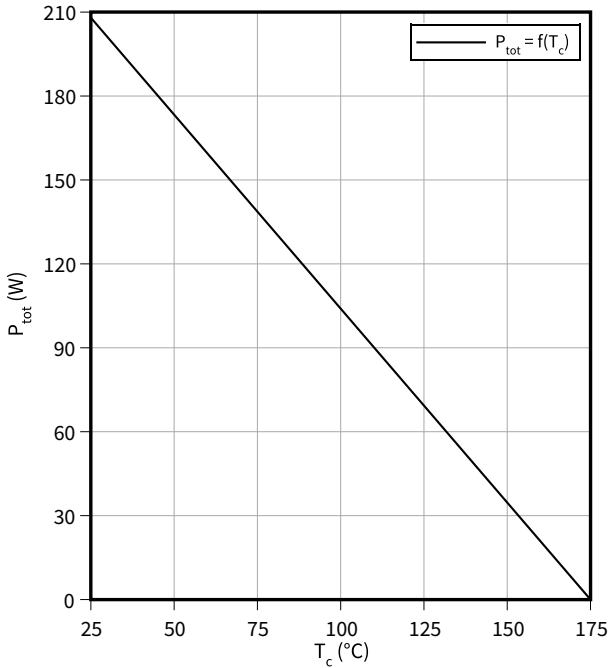
Dynamic test circuit, parasitic inductance $L_\sigma = 30\text{ nH}$, parasitic capacitor $C_\sigma = 23\text{ pF}$ from Fig. C.

2nd device for EC7 Diode = IDWD40E65E7

4 Characteristics diagrams

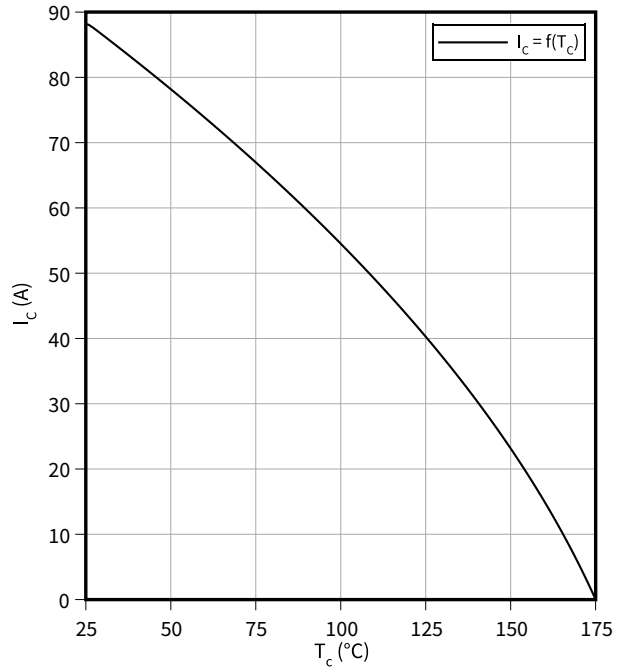
Power dissipation as a function of case temperature

$P_{tot} = f(T_c)$
 $T_{vj} \leq 175\text{ °C}$



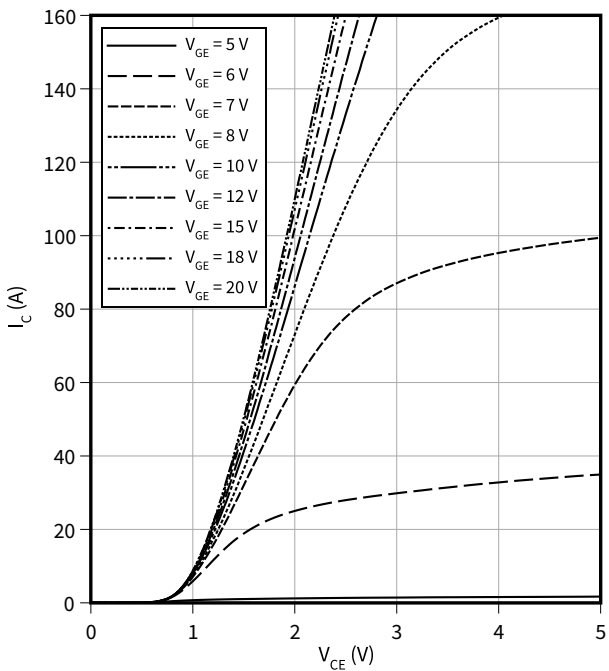
Collector current as a function of case temperature

$I_C = f(T_c)$
 $T_{vj} \leq 175\text{ °C}, V_{GE} \geq 15\text{ V}$



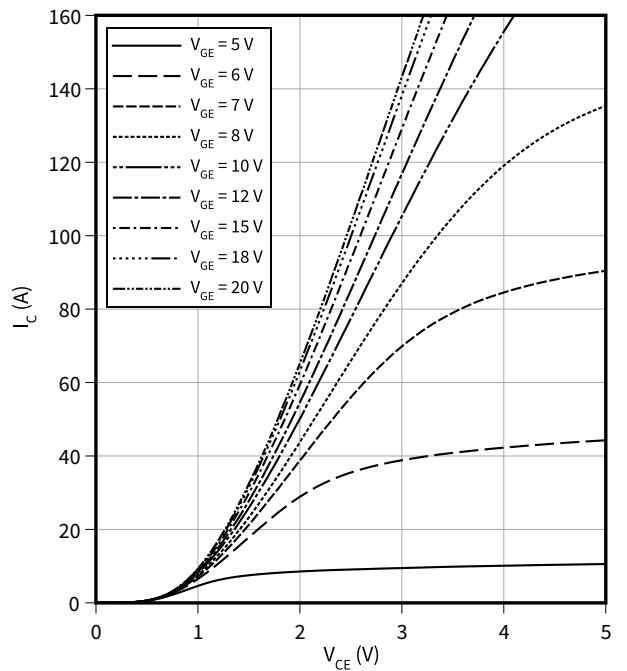
Typical output characteristic

$I_C = f(V_{CE})$
 $T_{vj} = 25\text{ °C}$



Typical output characteristic

$I_C = f(V_{CE})$
 $T_{vj} = 175\text{ °C}$

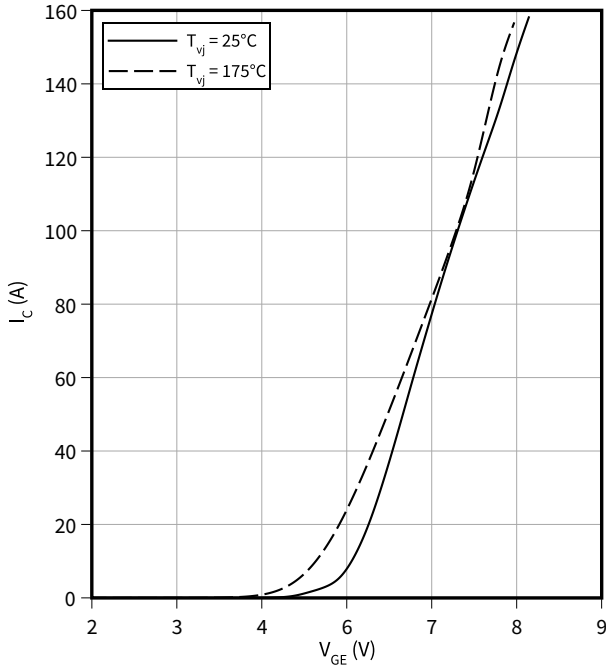


4 Characteristics diagrams

Typical transfer characteristic

$I_C = f(V_{GE})$

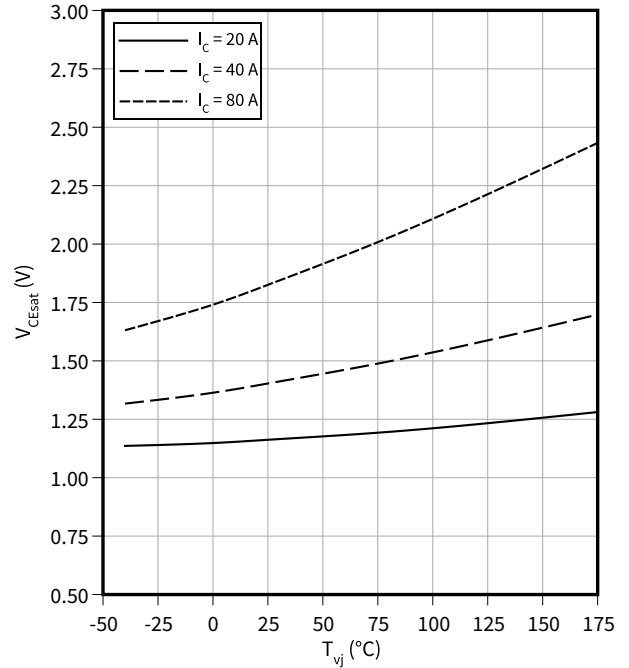
$V_{CE} = 20\text{ V}$



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

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

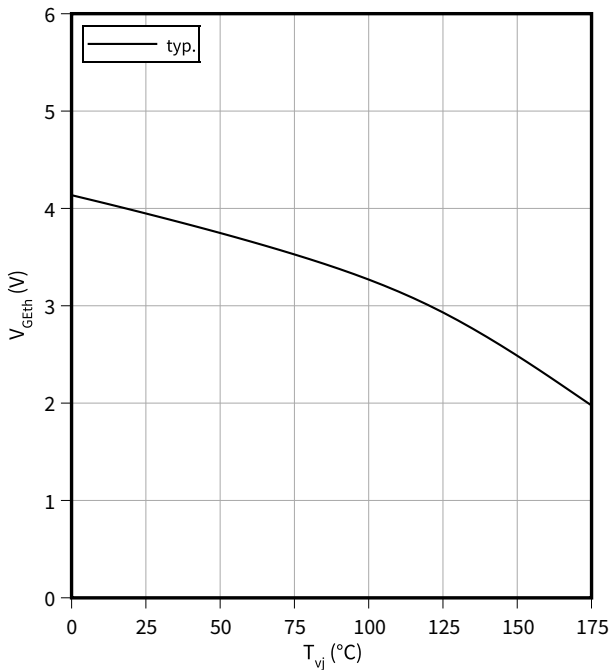
$V_{GE} = 15\text{ V}$



Gate-emitter threshold voltage as a function of junction temperature

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

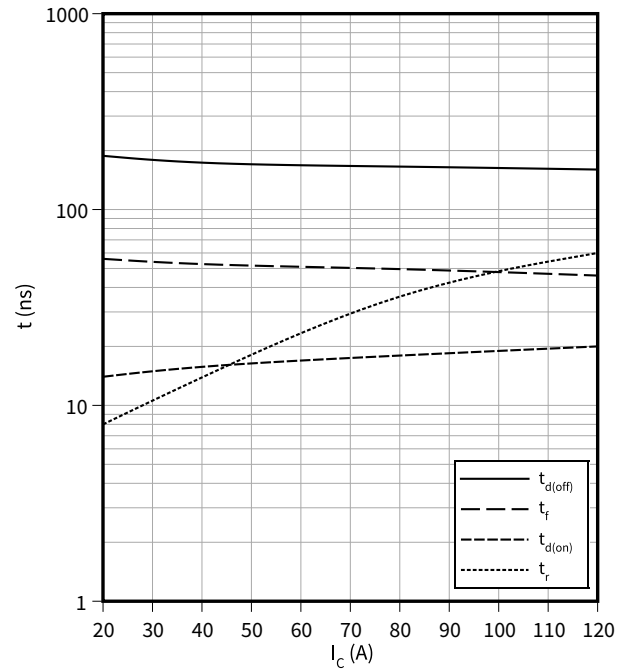
$I_C = 0.228\text{ mA}$



Typical switching times as a function of collector current

$t = f(I_C)$

$V_{CC} = 400\text{ V}, T_{vj} = 175^\circ\text{C}, V_{GE} = 0/15\text{ V}, R_G = 9.8\ \Omega$

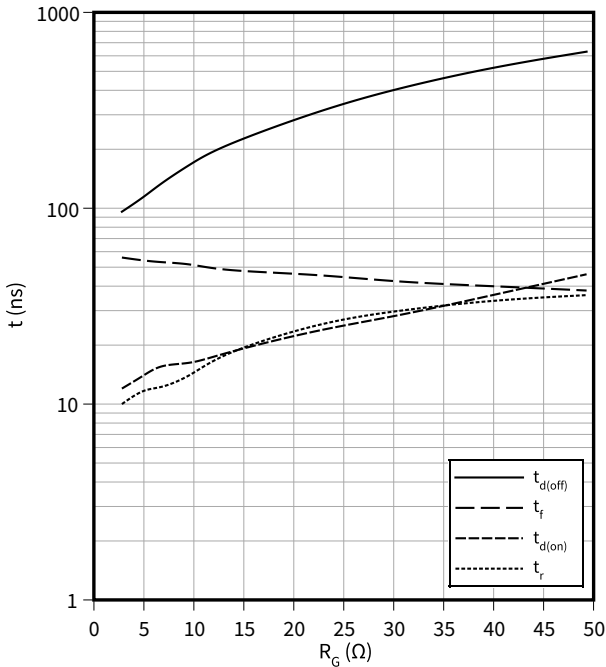


4 Characteristics diagrams

Typical switching times as a function of gate resistor

$t = f(R_G)$

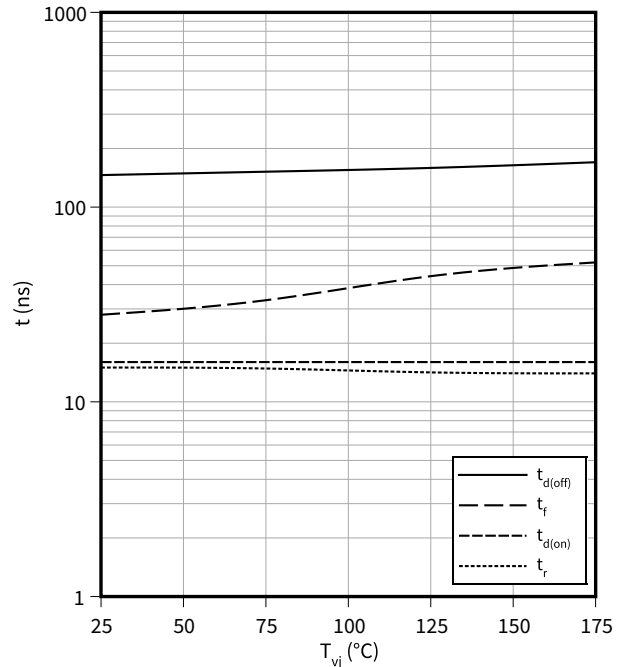
$I_C = 40\text{ A}, V_{CC} = 400\text{ V}, T_{vj} = 175\text{ °C}, V_{GE} = 0/15\text{ V}$



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

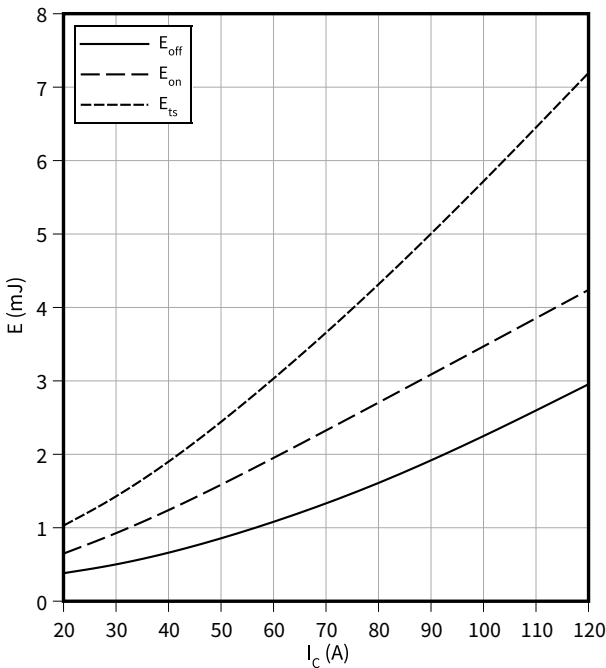
$I_C = 40\text{ A}, V_{CC} = 400\text{ V}, V_{GE} = 0/15\text{ V}, R_G = 9.8\text{ }\Omega$



Typical switching energy losses as a function of collector current

$E = f(I_C)$

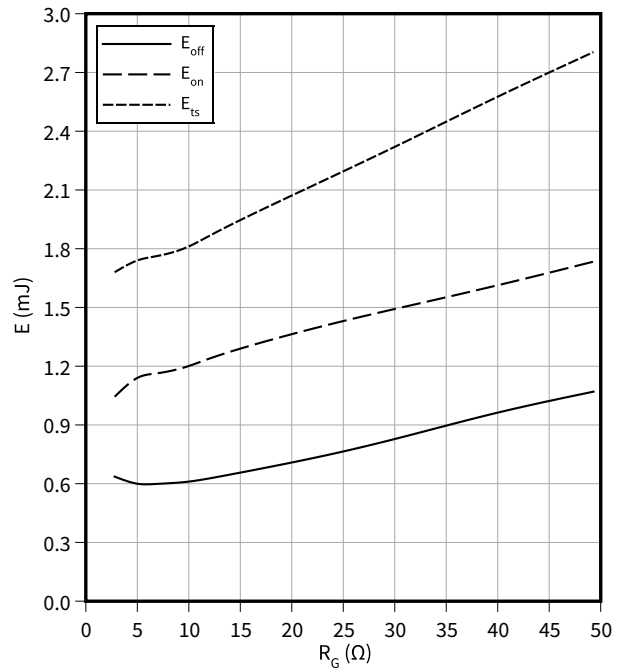
$V_{CC} = 400\text{ V}, T_{vj} = 175\text{ °C}, V_{GE} = 0/15\text{ V}, R_G = 9.8\text{ }\Omega$



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

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

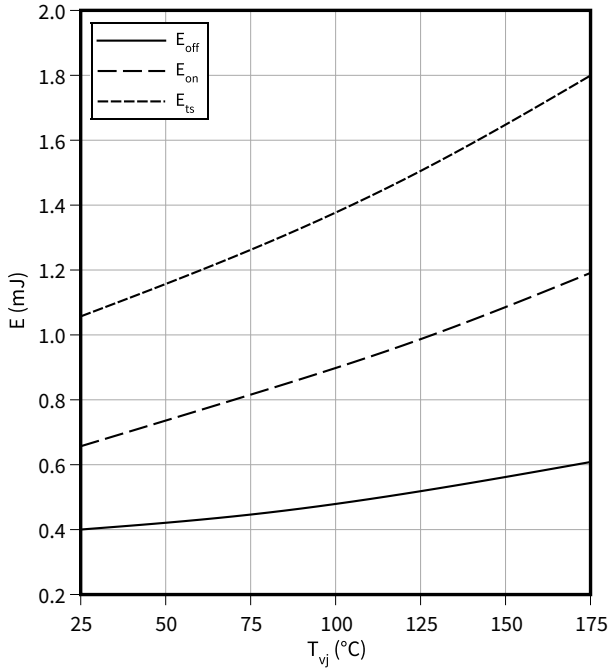


4 Characteristics diagrams

Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

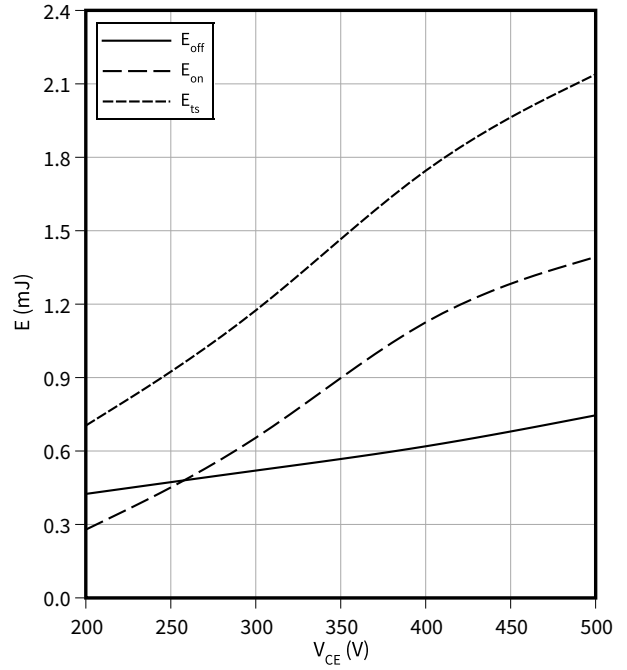
$I_C = 40\text{ A}$, $V_{CC} = 400\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_G = 9.8\ \Omega$



Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$

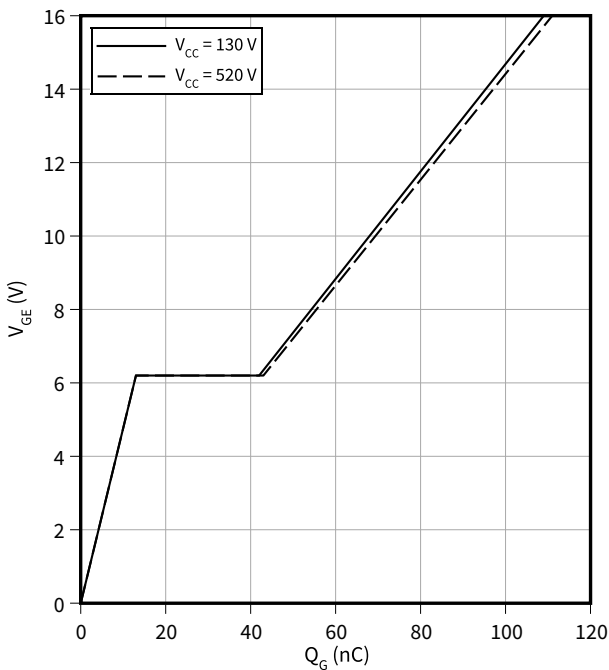
$I_C = 40\text{ A}$, $T_{vj} = 175\text{ °C}$, $V_{GE} = 0/15\text{ V}$, $R_G = 9.8\ \Omega$



Typical gate charge

$V_{GE} = f(Q_G)$

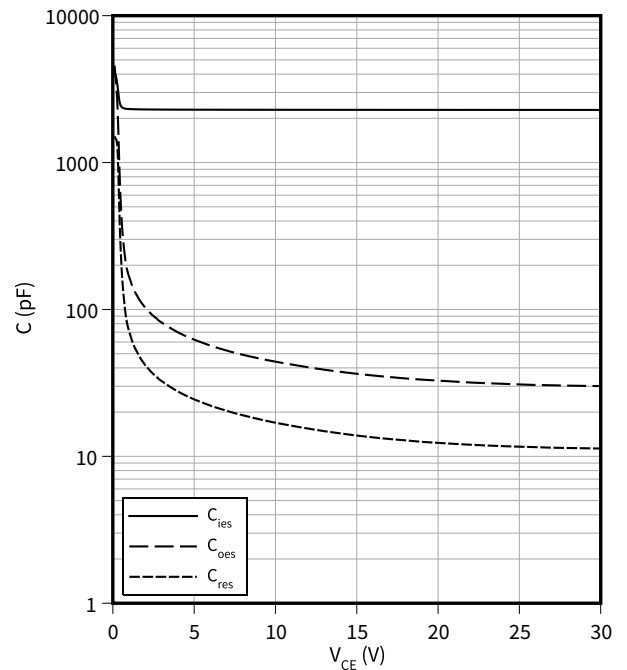
$I_C = 40\text{ A}$



Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE})$

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

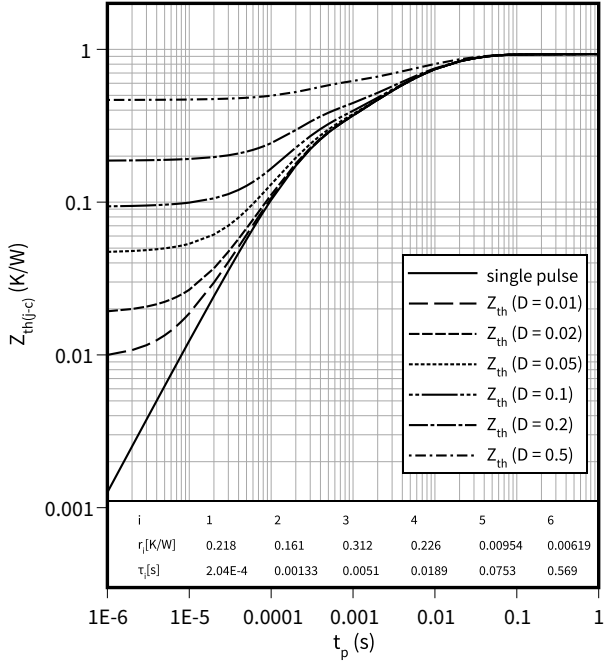


4 Characteristics diagrams

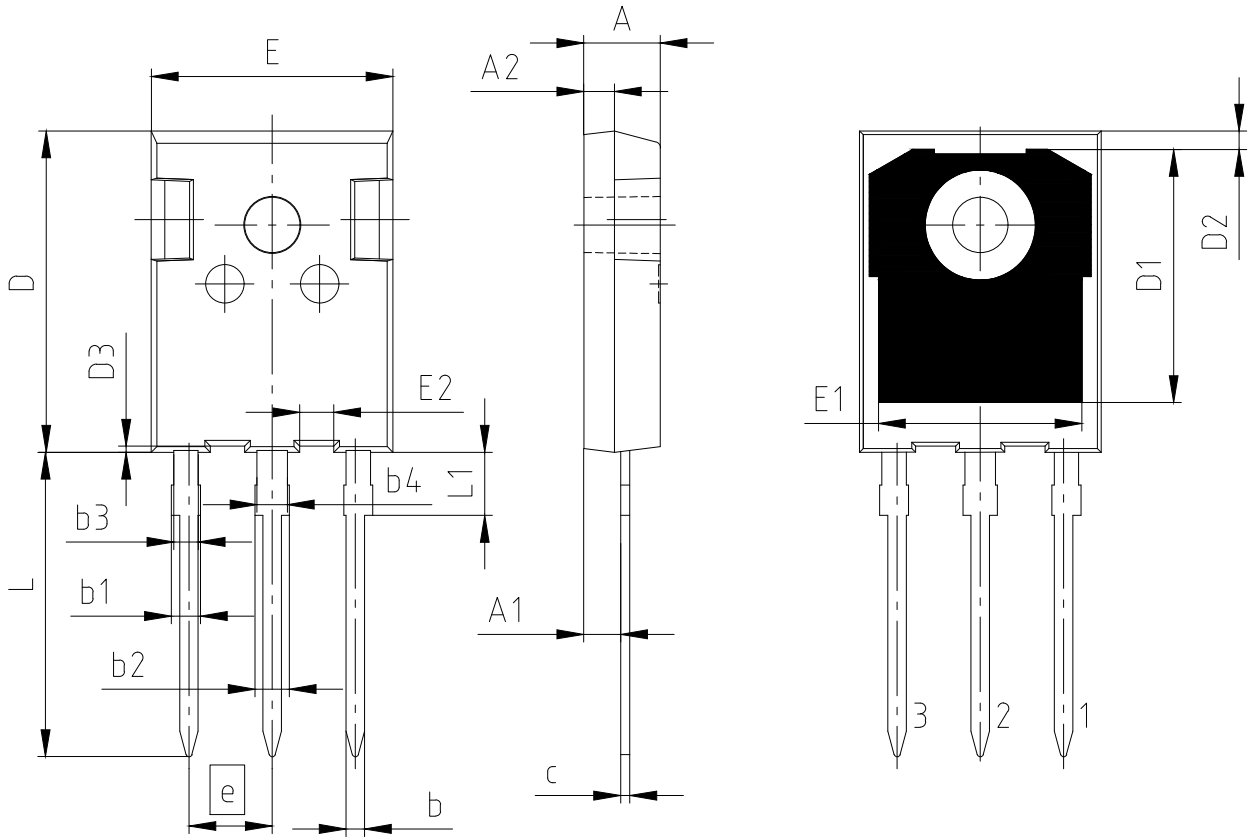
IGBT transient thermal impedance as a function of pulse width

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

$$D = t_p/T$$



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

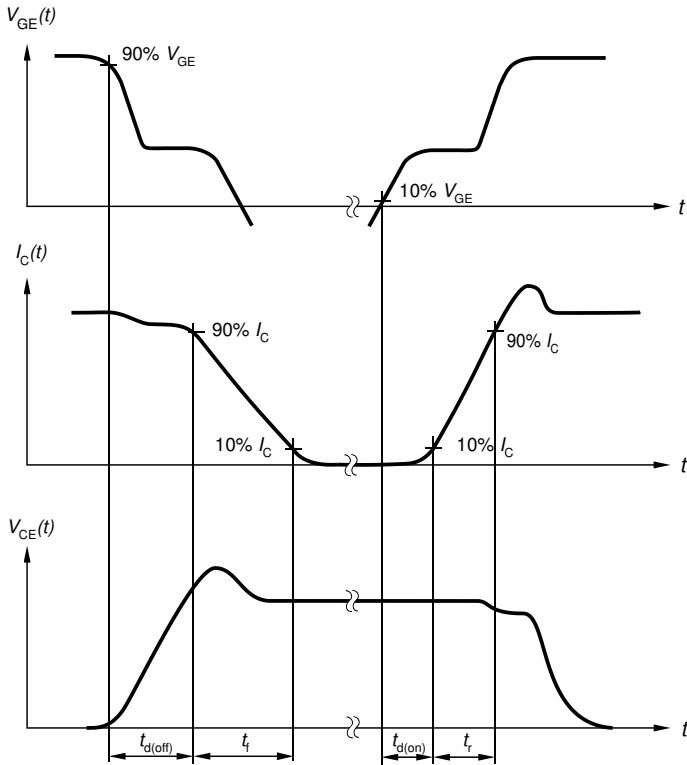


Figure A. Definition of switching times

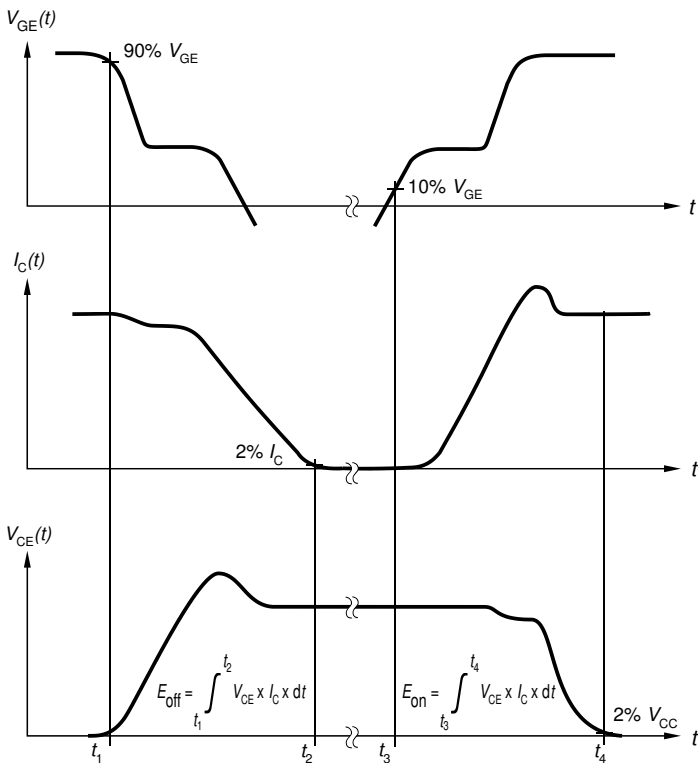


Figure B. Definition of switching losses

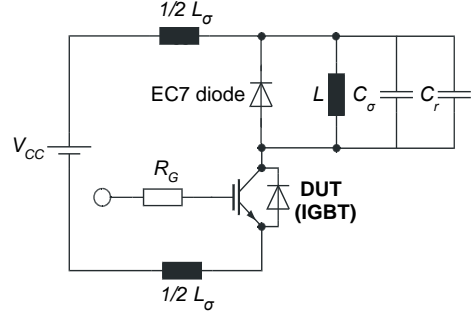


Figure C. Dynamic test circuit

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

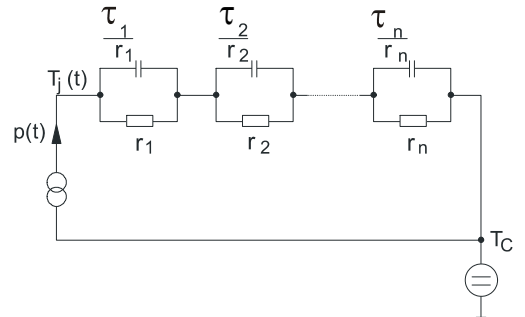


Figure D. Thermal equivalent circuit

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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