Final datasheet

High speed IGBT in Trench and Fieldstop technology recommended in combination with SiC diode IDH15S120

Features

- V_{CE} = 1200 V
- I_C = 40 A
- TRENCHSTOP™ technology offering
- Best-in-class switching performance: less than 500 µJ total switching losses achievable
- Very low V_{CEsat}
- Low EMI
- Maximum junction temperature T_{vjmax} = 175°C
- Qualified according to JEDEC for target applications
- Pb-free lead plating; RoHS compliant
- Complete product spectrum and PSpice Models: http://www.infineon.com/igbt/

Lead-free
Green
Halogen-free
RoHS

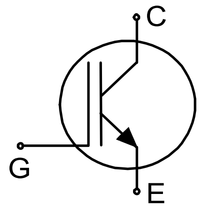
Potential applications

- Solar inverters
- Uninterruptible power supplies
- Welding converters
- Converters with high switching frequency

Description

Package pin definition:

- Pin G – Gate
- Pin C & backside – Collector
- Pin E – Emitter



Type	Package	Marking
IGW40N120H3	PG-TO247-3	G40H1203

Table of contents

1 IGBT

Table 1 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		$T_c = 25$ °C	80	A
			$T_c = 100$ °C	40	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}			160	A
Turn-off safe operating area		$V_{CE} \leq 1200$ V, $T_{vj} \leq 175$ °C		160	A
Gate-emitter voltage	V_{GE}			±20	V
Transient gate-emitter voltage	V_{GE}	$t_p \leq 10$ µs, $D < 0.01$		±30	V
Short-circuit withstand time	t_{SC}	$V_{CC} \leq 600$ V, $V_{GE} = 15$ V, Allowed number of short circuits < 1000, Time between short circuits ≥ 1.0 s, $T_{vj} = 175$ °C		10	µs

Table 2 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter breakdown voltage	V_{BRCES}	$I_C = 0.5$ mA, $V_{GE} = 0$ V		1200			V
Collector-emitter saturation voltage	V_{CEsat}	$I_C = 40$ A, $V_{GE} = 15$ V	$T_{vj} = 25$ °C		2.05	2.4	V
			$T_{vj} = 125$ °C		2.5		
			$T_{vj} = 175$ °C		2.7		
Gate-emitter threshold voltage	V_{GEth}	$I_C = 1.5$ mA, $V_{CE} = V_{GE}$		5	5.8	6.5	V
Zero gate-voltage collector current	I_{CES}	$V_{CE} = 1200$ V, $V_{GE} = 0$ V	$T_{vj} = 25$ °C			250	µA
			$T_{vj} = 175$ °C			2500	
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0$ V, $V_{GE} = 20$ V				600	nA
Transconductance	g_{fs}	$I_C = 40$ A, $V_{CE} = 20$ V			20		S
Short-circuit collector current	I_{SC}	$V_{CC} \leq 600$ V, $V_{GE} = 15$ V, $t_{SC} \leq 10$ µs, Allowed number of short circuits < 1000, Time between short circuits ≥ 1.0 s, $T_{vj} = 175$ °C			139		A
Input capacitance	C_{ies}	$V_{CE} = 25$ V, $V_{GE} = 0$ V, $f = 1000$ kHz			2330		pF
Output capacitance	C_{oes}	$V_{CE} = 25$ V, $V_{GE} = 0$ V, $f = 1000$ kHz			150		pF
Reverse transfer capacitance	C_{res}	$V_{CE} = 25$ V, $V_{GE} = 0$ V, $f = 1000$ kHz			130		pF

(table continues...)

Table 2 **(continued) Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Gate charge	Q_G	V_{CC} = 960 V, I_C = 40 A, V_{GE} = 15 V			185		nC
Turn-on delay time	$t_{d(on)}$	V_{CC} = 600 V, V_{GE} = 0/15 V, R_G = 12 Ω	T_{vj} = 25 °C, I_C = 40 A		30		ns
			T_{vj} = 175 °C, I_C = 40 A		29		
Rise time (inductive load)	t_r	V_{CC} = 600 V, V_{GE} = 0/15 V, R_G = 12 Ω	T_{vj} = 25 °C, I_C = 40 A		57		ns
			T_{vj} = 175 °C, I_C = 40 A		49		
Turn-off delay time	$t_{d(off)}$	V_{CC} = 600 V, V_{GE} = 0/15 V, R_G = 12 Ω	T_{vj} = 25 °C, I_C = 40 A		290		ns
			T_{vj} = 175 °C, I_C = 40 A		366		
Fall time (inductive load)	t_f	V_{CC} = 600 V, V_{GE} = 0/15 V, R_G = 12 Ω	T_{vj} = 25 °C, I_C = 40 A		16		ns
			T_{vj} = 175 °C, I_C = 40 A		48		
Turn-on energy	E_{on}	V_{CC} = 600 V, V_{GE} = 0/15 V, R_G = 12 Ω	T_{vj} = 25 °C, I_C = 40 A		1.93		mJ
			T_{vj} = 175 °C, I_C = 40 A		2.21		
Turn-off energy	E_{off}	V_{CC} = 600 V, V_{GE} = 0/15 V, R_G = 12 Ω	T_{vj} = 25 °C, I_C = 40 A		1.23		mJ
			T_{vj} = 175 °C, I_C = 40 A		2.66		
Total switching energy	E_{ts}	V_{CC} = 600 V, V_{GE} = 0/15 V, R_G = 12 Ω	T_{vj} = 25 °C, I_C = 40 A		3.16		mJ
			T_{vj} = 175 °C, I_C = 40 A		4.87		
Operating junction temperature	T_{vj}			-40		175	°C

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

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

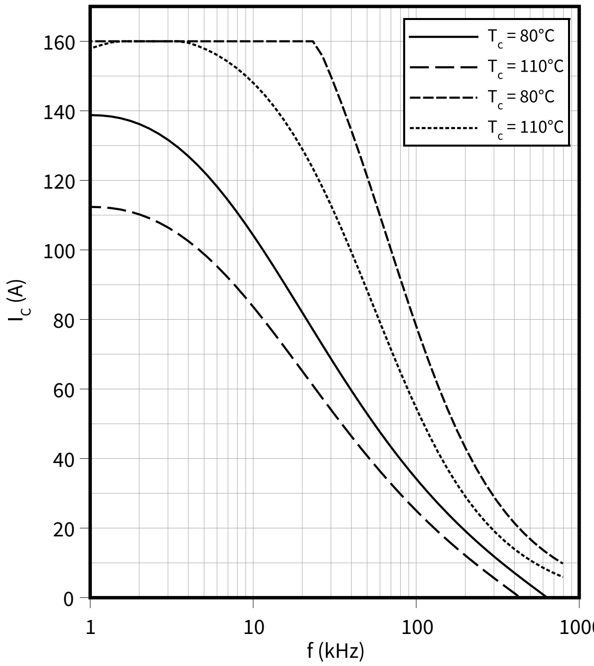
Dynamic test circuit: L_σ = 70 nH, C_σ = 67 pF from Figure E. Energy losses include "tail" and diode (IDH15S120) reverse recovery.

2 Characteristics diagrams

Collector current as a function of switching frequency

$I_C = f(f)$

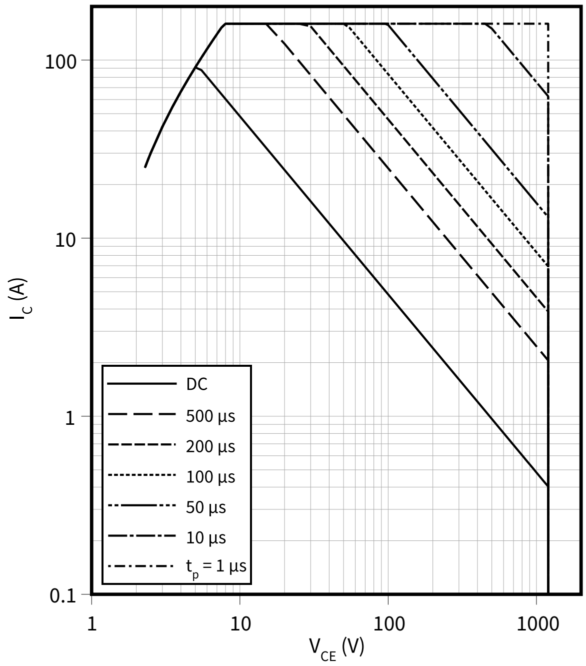
$D = 0.5$, $V_{CE} = 600$ V, $T_{vj} \leq 175$ °C, $V_{GE} = 0/15$ V, $R_G = 12\ \Omega$



Forward bias safe operating area

$I_C = f(V_{CE})$

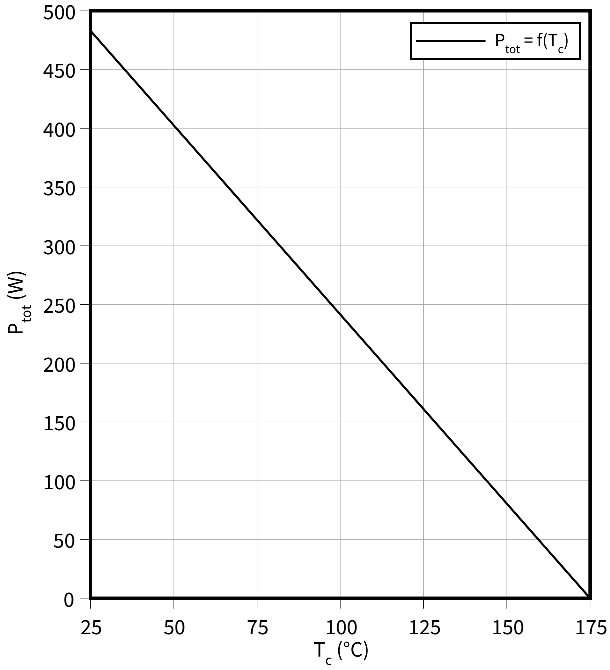
$D = 0$, $T_{vj} \leq 175$ °C, $V_{GE} = 15$ V, $T_c = 25$ °C



Power dissipation as a function of case temperature

$P_{tot} = f(T_c)$

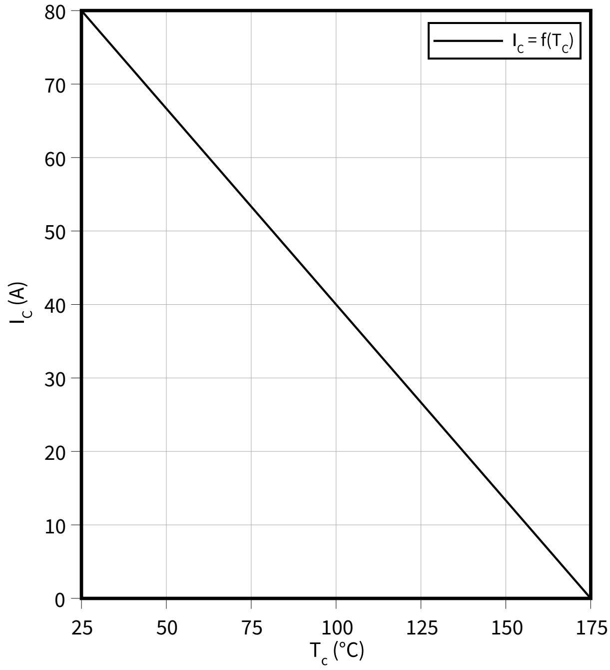
$T_{vj} \leq 175$ °C



Collector current as a function of case temperature

$I_C = f(T_c)$

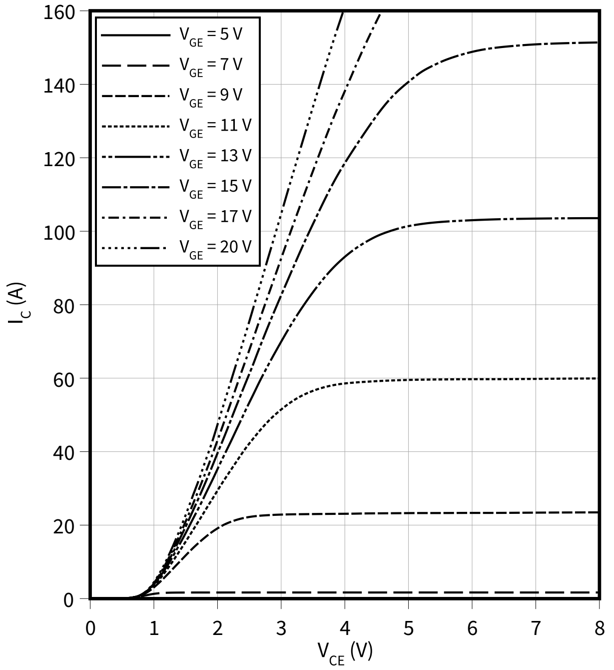
$T_{vj} \leq 175$ °C, $V_{GE} \geq 15$ V



Typical output characteristic

$I_C = f(V_{CE})$

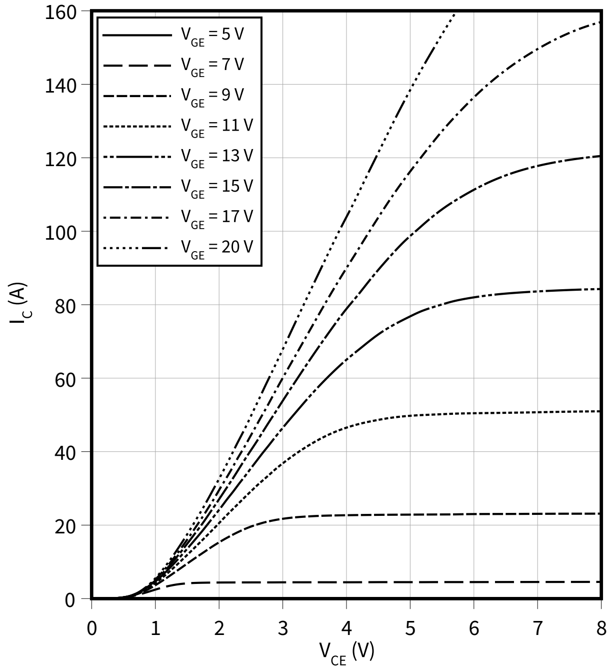
$T_{vj} = 25\ °C$



Typical output characteristic

$I_C = f(V_{CE})$

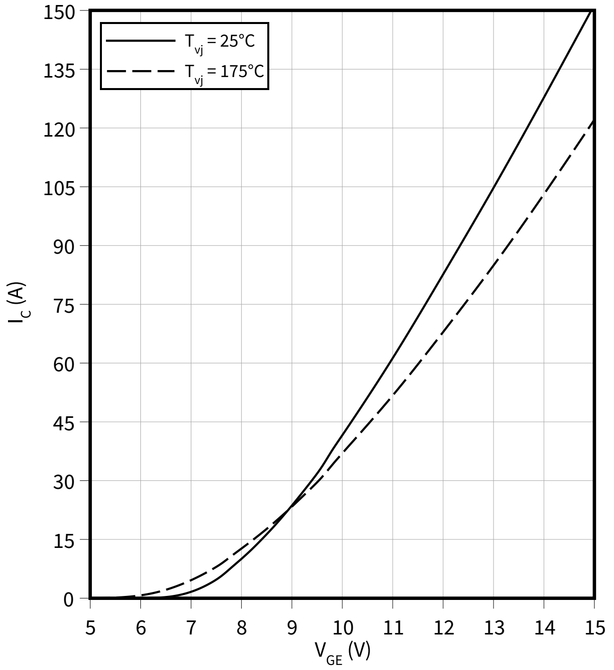
$T_{vj} = 175\ °C$



Typical transfer characteristic

$I_C = f(V_{GE})$

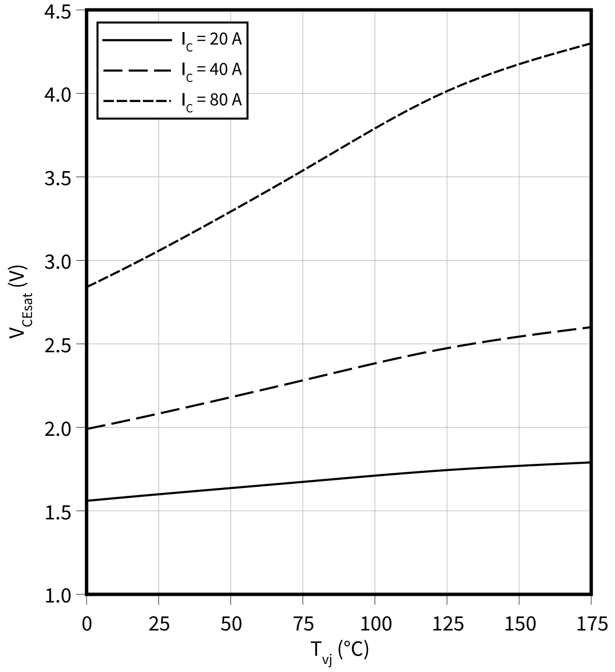
$V_{CE} = 20\ V$



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

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

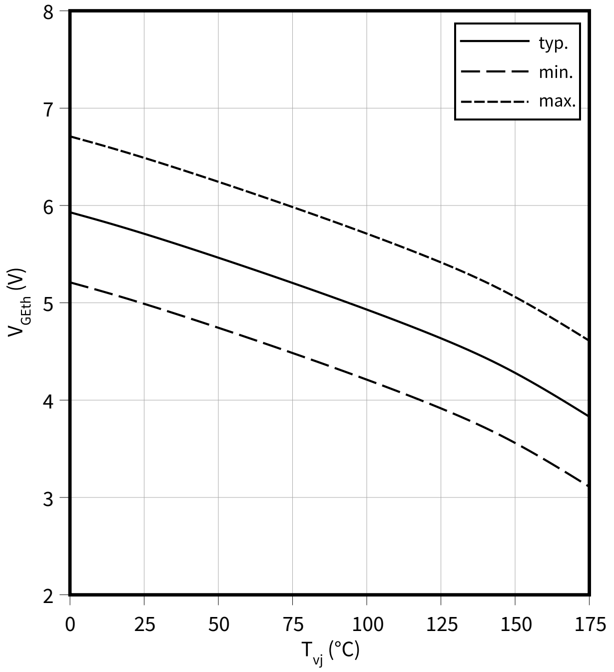
$V_{GE} = 15\ V$



Gate-emitter threshold voltage as a function of junction temperature

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

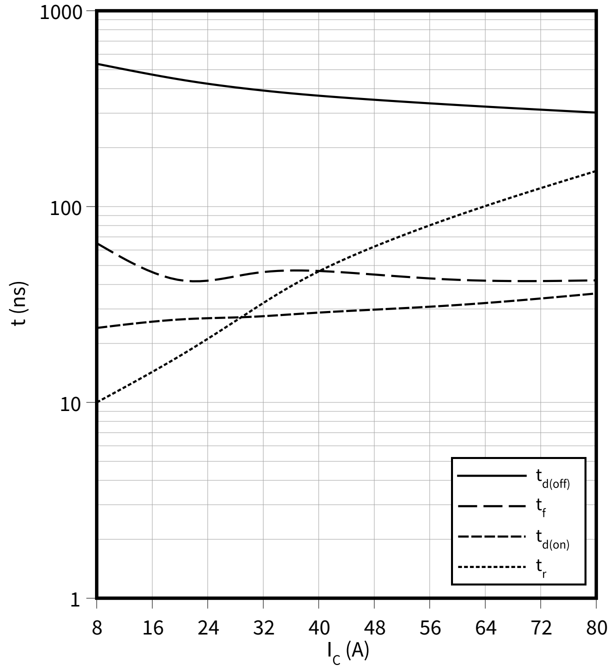
$I_C = 1.5$ mA



Typical switching times as a function of collector current

$t = f(I_C)$

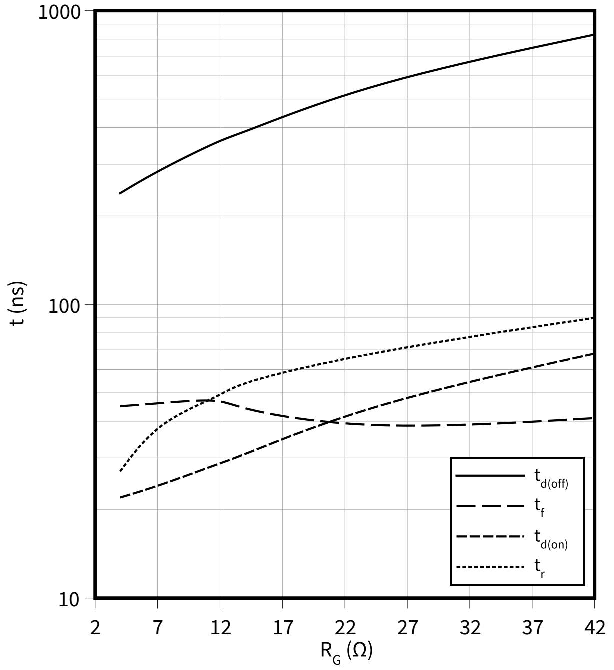
$V_{CC} = 600$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 12\ \Omega$



Typical switching times as a function of gate resistor

$t = f(R_G)$

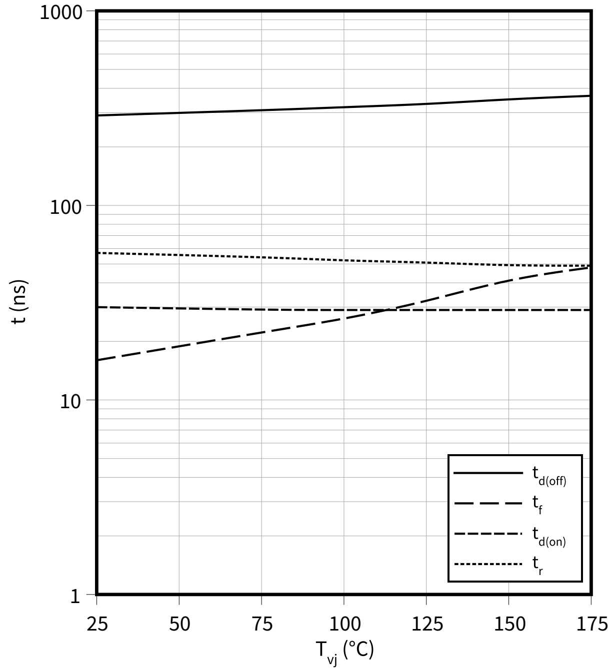
$I_C = 40$ A, $V_{CC} = 600$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

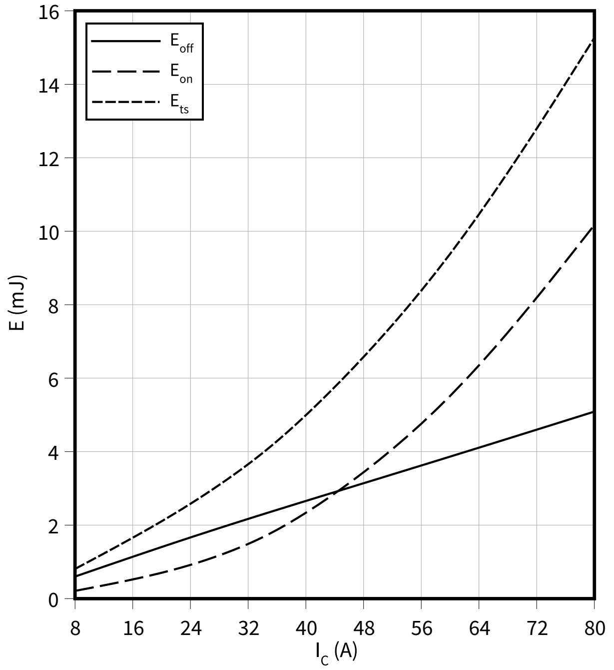
$I_C = 40$ A, $V_{CC} = 600$ V, $V_{GE} = 0/15$ V, $R_G = 12\ \Omega$



Typical switching energy losses as a function of collector current

$E = f(I_C)$

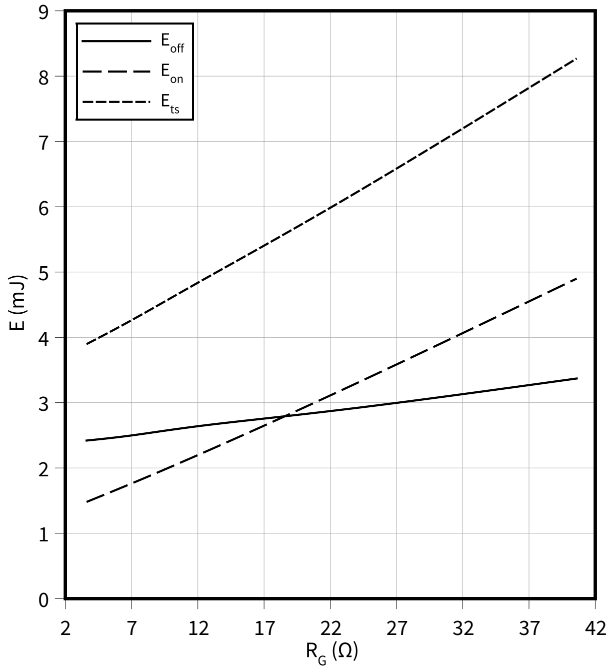
$V_{CC} = 600$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 12$ Ω



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

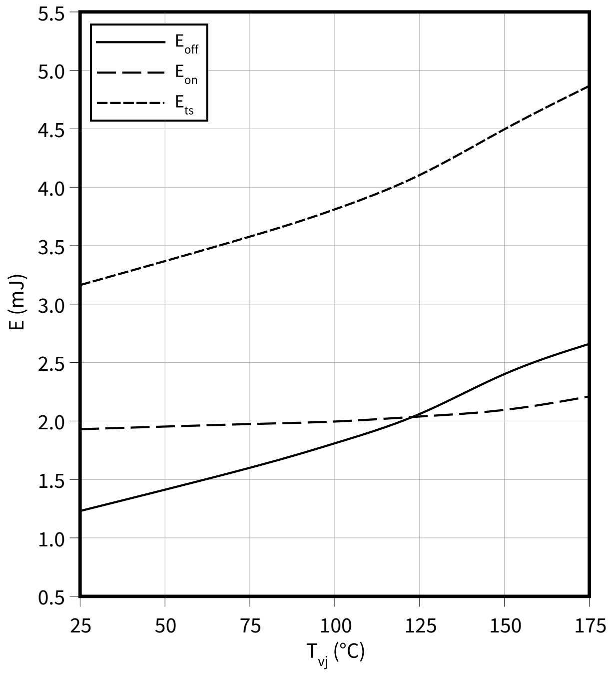
$I_C = 40$ A, $V_{CC} = 600$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V



Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

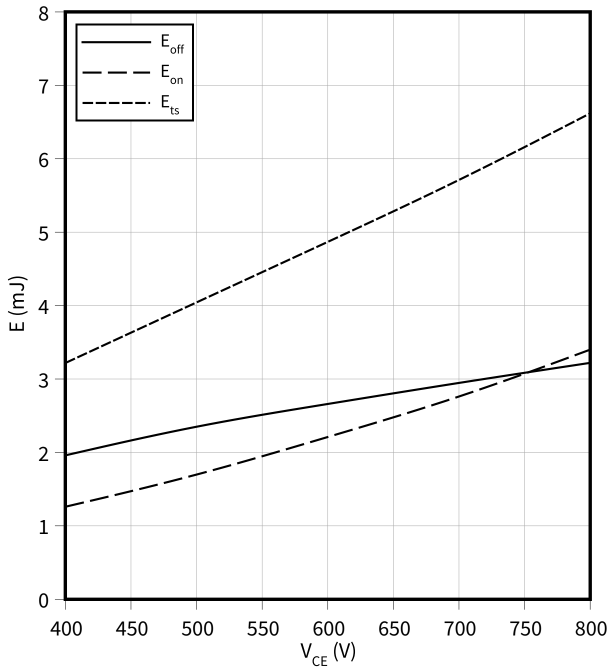
$I_C = 40$ A, $V_{CC} = 600$ V, $V_{GE} = 0/15$ V, $R_G = 12$ Ω



Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$

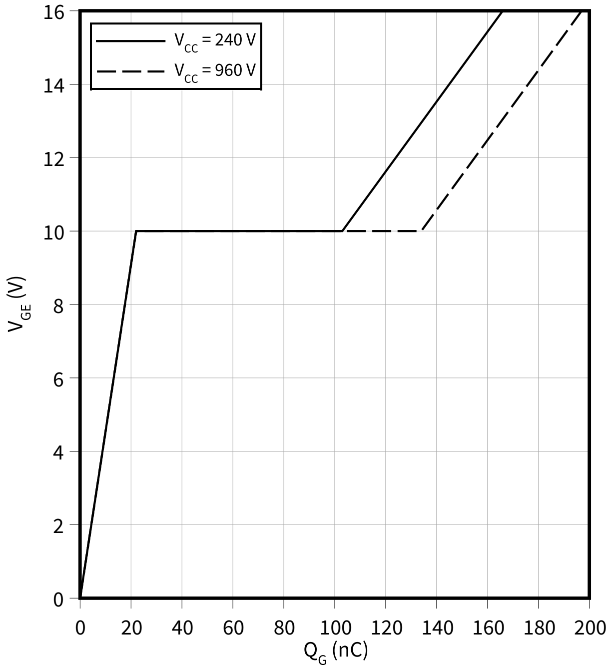
$I_C = 40$ A, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 12$ Ω



Typical gate charge

$V_{GE} = f(Q_G)$

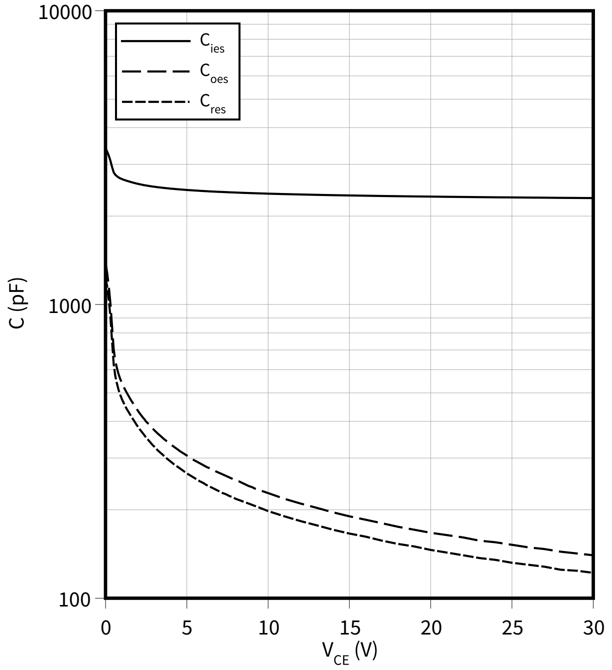
$I_C = 40$ A



Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE})$

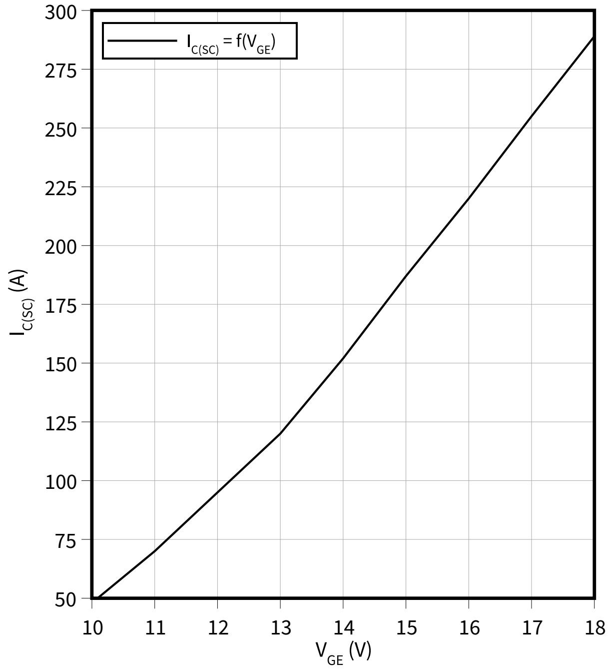
f = 1000 kHz, $V_{GE} = 0$ V



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

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

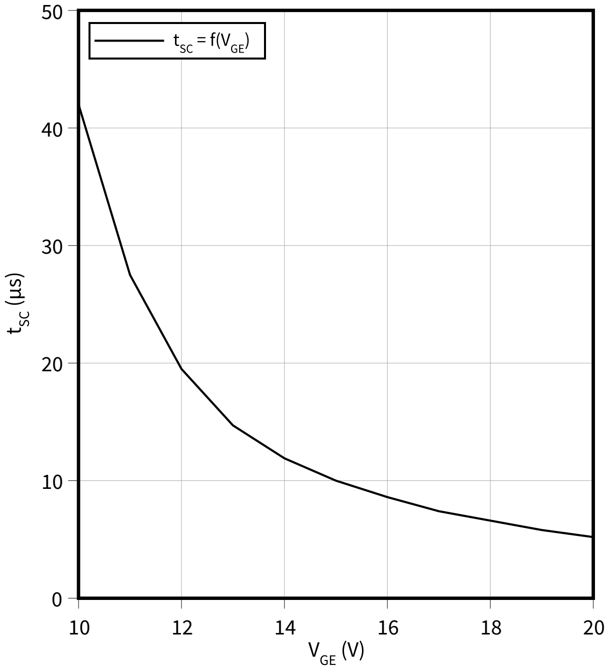
$T_{vj,\ start} = 25$ °C, $V_{CC} \leq 600$ V



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

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

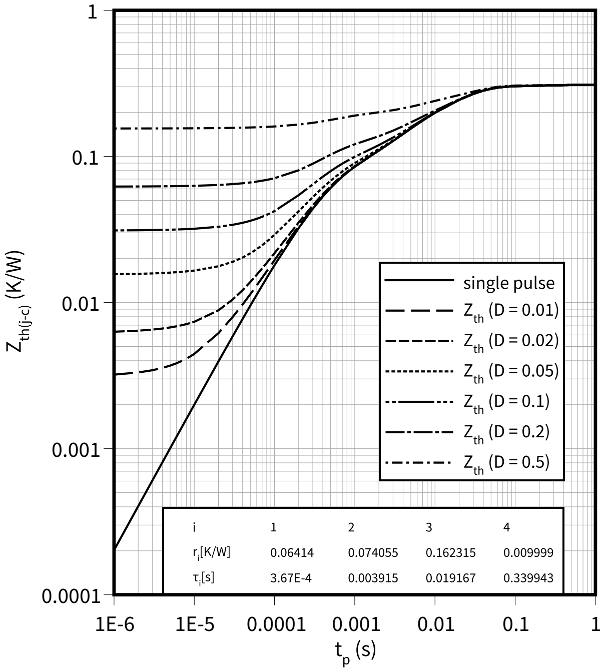
$T_{vj,\ start} \leq 150$ °C, $V_{CC} \leq 600$ V



IGBT transient thermal impedance as a function of pulse width

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

$D = t_p/T$



Revision history

Document revision	Date of release	Description of changes
V2.1	2012-07-31	Final data sheet
V2.2	2014-11-26	Minor change Figure 7
V2.3	2015-10-08	Minor change Static Characteristic
n/a	2020-11-30	Datasheet migrated to a new system with a new layout and new revision number schema: target or preliminary datasheet = 0.xy; final datasheet = 1.xy
1.10	2025-06-12	Added transient Gate-emitter voltage Editorial changes

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Email: erratum@infineon.com

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