

### Final datasheet

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

#### Features

- $V_{CE} = 1200\text{ V}$
- $I_C = 40\text{ A}$
- TRENCHSTOP™ technology offering
- Best-in-class switching performance: less than 500  $\mu\text{J}$  total switching losses achievable
- Very low  $V_{CEsat}$
- Low EMI
- Maximum junction temperature  $T_{vjmax} = 175^\circ\text{C}$
- 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

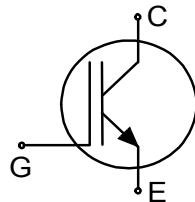
#### Potential applications

- 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-T0247-3	G40H1203

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## 1 IGBT

**Table 1** Maximum rated values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter voltage	$V_{CE}$	$T_{vj} \geq 25\text{ °C}$	1200			V
DC collector current, limited by $T_{vjmax}$	$I_C$		$T_c = 25\text{ °C}$	80		A
			$T_c = 100\text{ °C}$	40		
Pulsed collector current, $t_p$ limited by $T_{vjmax}$	$I_{Cpulse}$		160			A
Turn-off safe operating area		$V_{CE} \leq 1200\text{ V}, T_{vj} \leq 175\text{ °C}$	160			A
Gate-emitter voltage	$V_{GE}$		$\pm 20$			V
Transient gate-emitter voltage	$V_{GE}$	$t_p \leq 10\text{ }\mu\text{s}, D < 0.01$	$\pm 30$			V
Short-circuit withstand time	$t_{SC}$	$V_{CC} \leq 600\text{ V}, V_{GE} = 15\text{ V}$ , Allowed number of short circuits < 1000, Time between short circuits $\geq 1.0\text{ s}, T_{vj} = 175\text{ °C}$	10			$\mu\text{s}$

**Table 2** Characteristic values

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

(table continues...)

**Table 2 (continued) Characteristic values**

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

**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  $T_{vj} = 25 \text{ }^\circ\text{C}$ , unless otherwise specified.

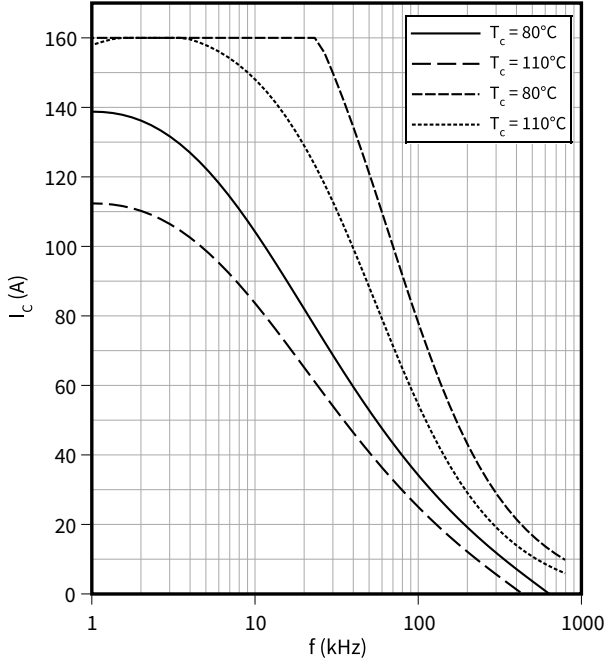
Dynamic test circuit:  $L_\sigma = 70 \text{ nH}$ ,  $C_\sigma = 67 \text{ pF}$  from Figure E. Energy losses include “tail” and diode (IDH15S120) reverse recovery.

## 2 Characteristics diagrams

### Collector current as a function of switching frequency

$$I_C = f(f)$$

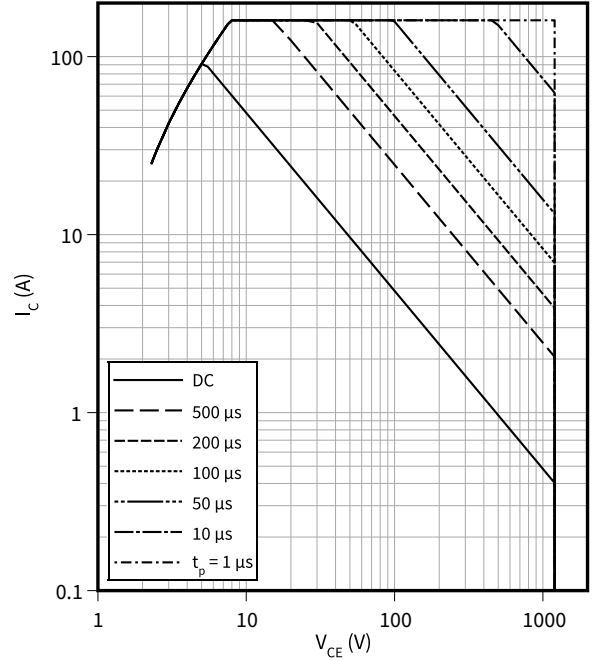
$D = 0.5, V_{CE} = 600 \text{ V}, T_{vj} \leq 175 \text{ }^\circ\text{C}, V_{GE} = 0/15 \text{ V}, R_G = 12 \text{ } \Omega$



### Forward bias safe operating area

$$I_C = f(V_{CE})$$

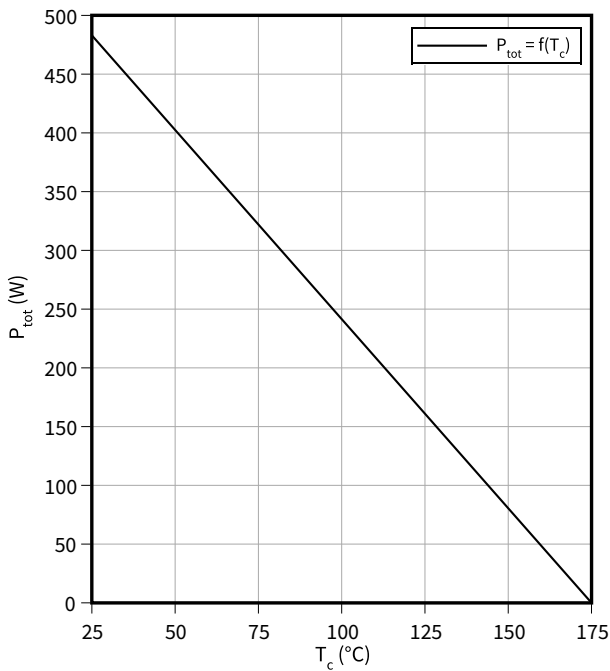
$D = 0, T_{vj} \leq 175 \text{ }^\circ\text{C}, V_{GE} = 15 \text{ V}, T_c = 25 \text{ }^\circ\text{C}$



### Power dissipation as a function of case temperature

$$P_{tot} = f(T_c)$$

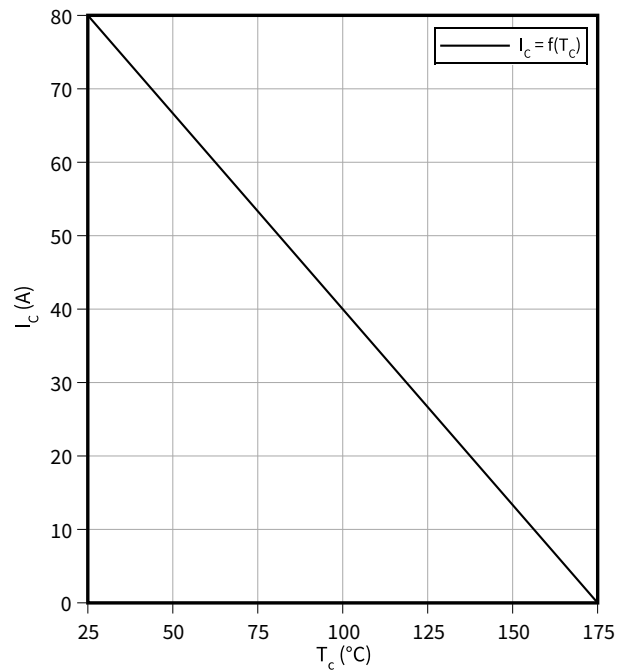
$T_{vj} \leq 175 \text{ }^\circ\text{C}$



### Collector current as a function of case temperature

$$I_C = f(T_c)$$

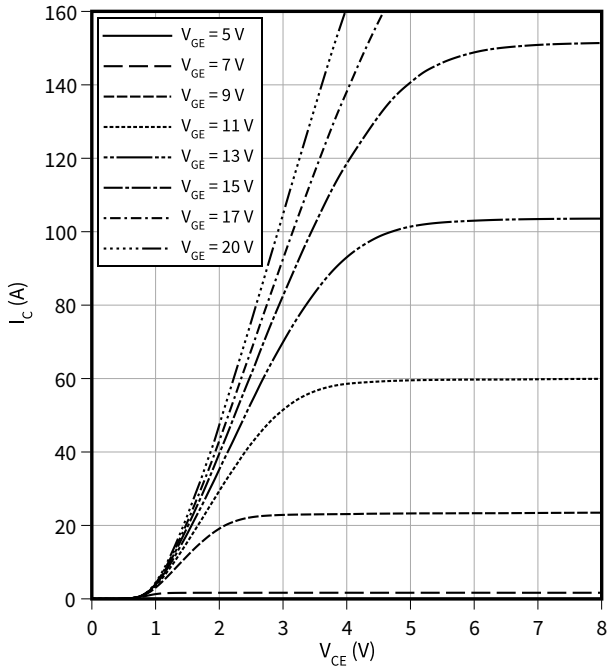
$T_{vj} \leq 175 \text{ }^\circ\text{C}, V_{GE} \geq 15 \text{ V}$



**2 Characteristics diagrams**

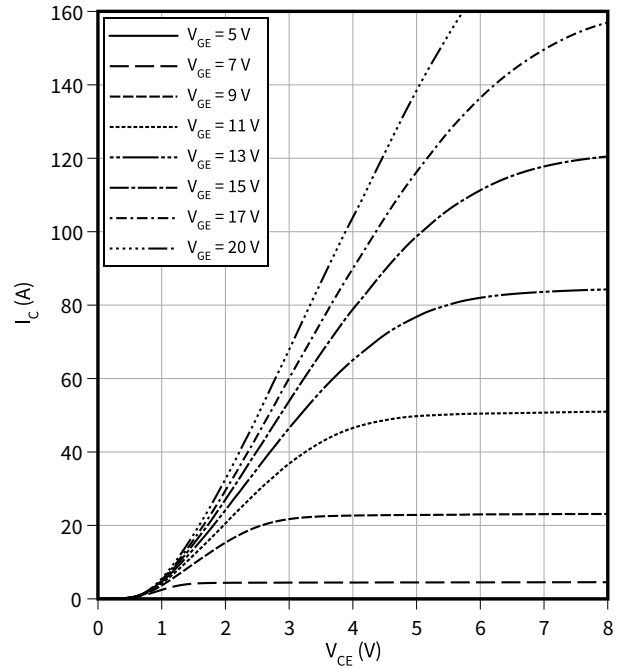
**Typical output characteristic**

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



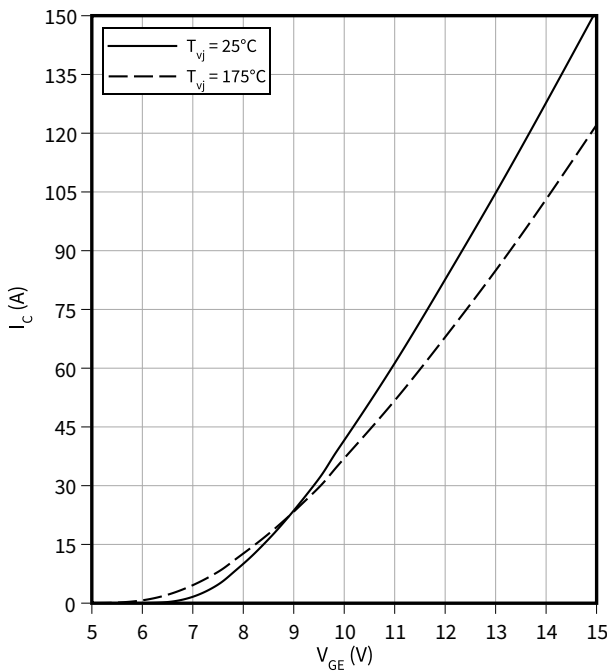
**Typical output characteristic**

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



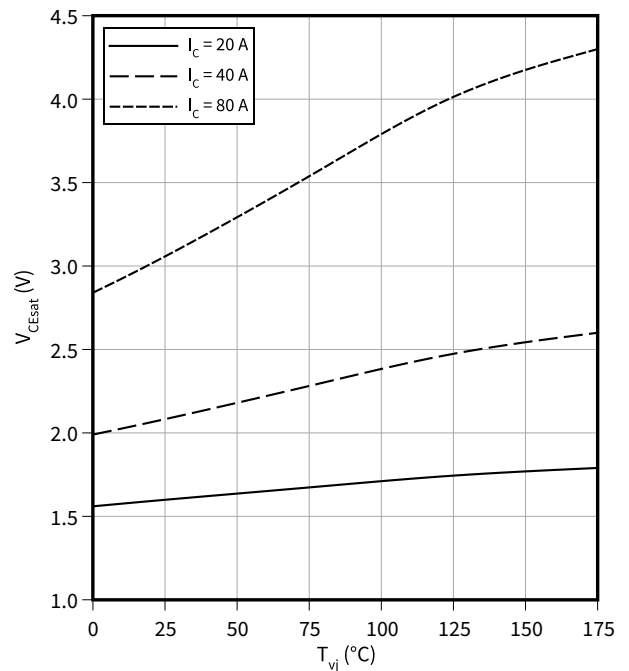
**Typical transfer characteristic**

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



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

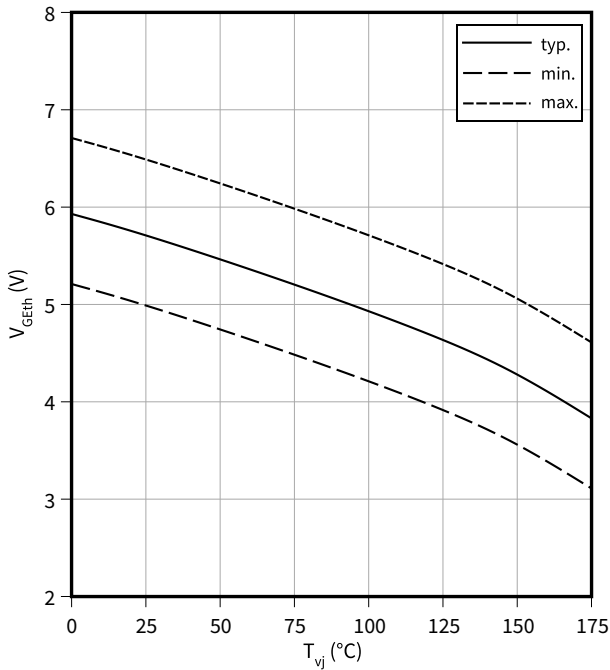
$V_{CEsat} = f(T_{vj})$   
 $V_{GE} = 15\text{ V}$



2 Characteristics diagrams

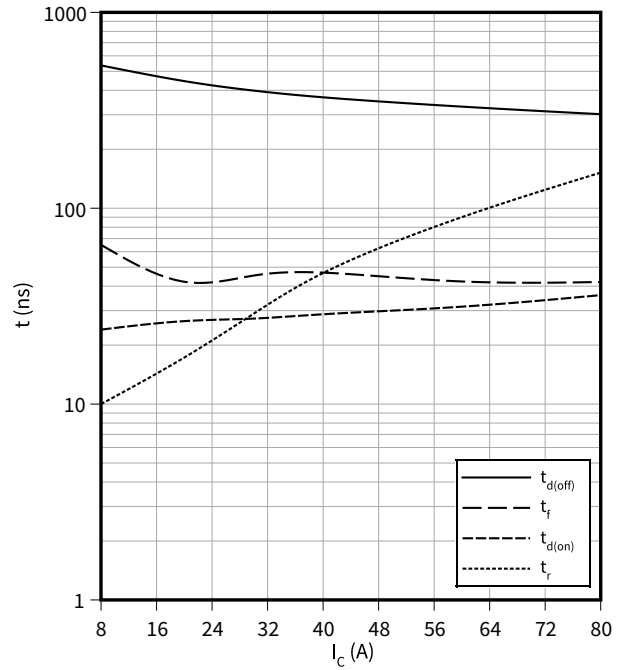
**Gate-emitter threshold voltage as a function of junction temperature**

$V_{GEth} = f(T_{vj})$   
 $I_C = 1.5 \text{ mA}$



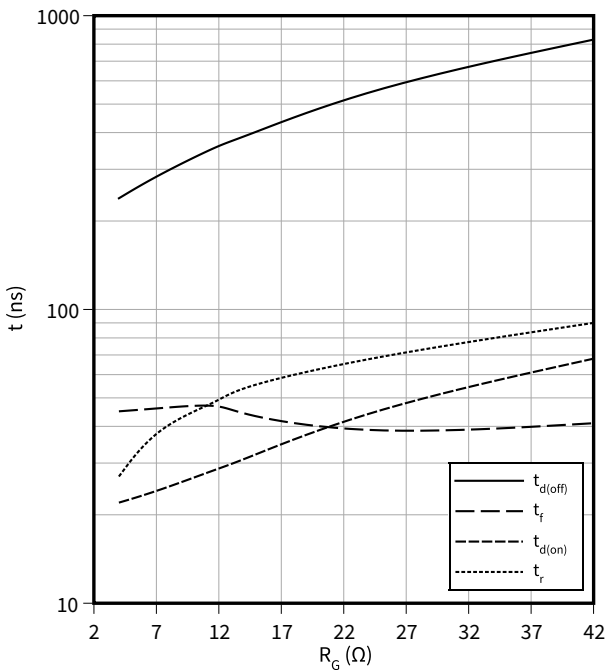
**Typical switching times as a function of collector current**

$t = f(I_C)$   
 $V_{CC} = 600 \text{ V}, T_{vj} = 175 \text{ °C}, V_{GE} = 0/15 \text{ V}, R_G = 12 \text{ } \Omega$



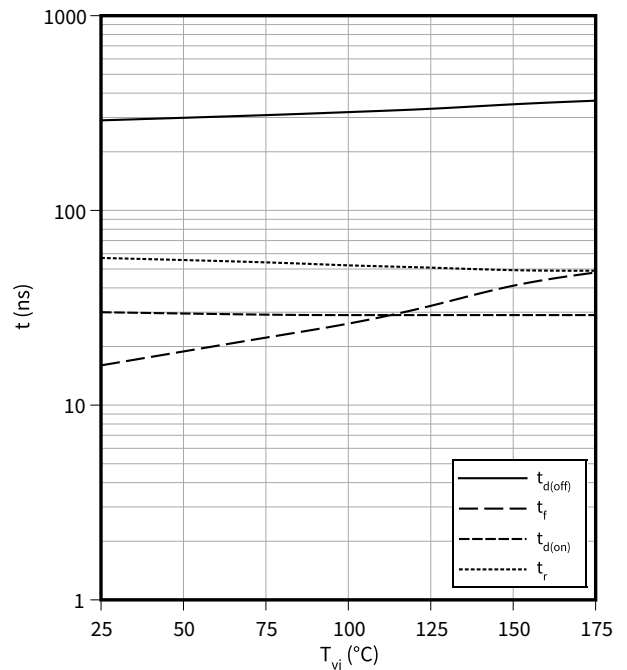
**Typical switching times as a function of gate resistor**

$t = f(R_G)$   
 $I_C = 40 \text{ A}, V_{CC} = 600 \text{ V}, T_{vj} = 175 \text{ °C}, V_{GE} = 0/15 \text{ V}$



**Typical switching times as a function of junction temperature**

$t = f(T_{vj})$   
 $I_C = 40 \text{ A}, V_{CC} = 600 \text{ V}, V_{GE} = 0/15 \text{ V}, R_G = 12 \text{ } \Omega$

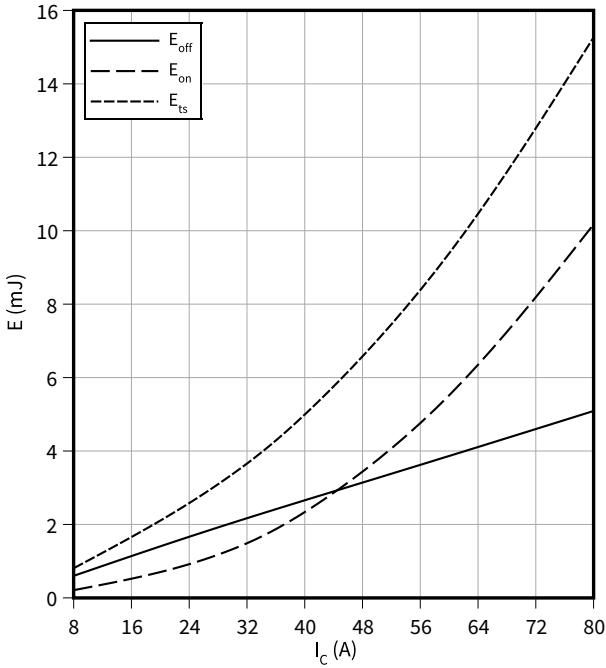


2 Characteristics diagrams

**Typical switching energy losses as a function of collector current**

$E = f(I_C)$

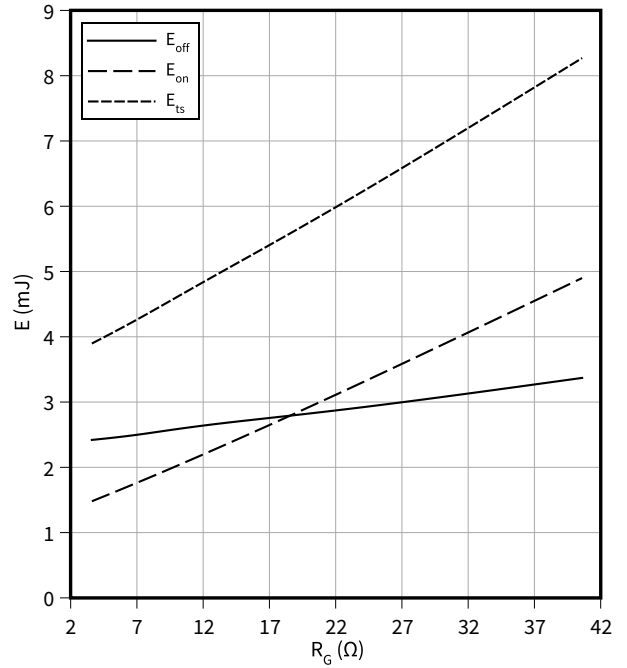
$V_{CC} = 600\text{ V}$ ,  $T_{vj} = 175\text{ }^\circ\text{C}$ ,  $V_{GE} = 0/15\text{ V}$ ,  $R_G = 12\text{ }\Omega$



**Typical switching energy losses as a function of gate resistor**

$E = f(R_G)$

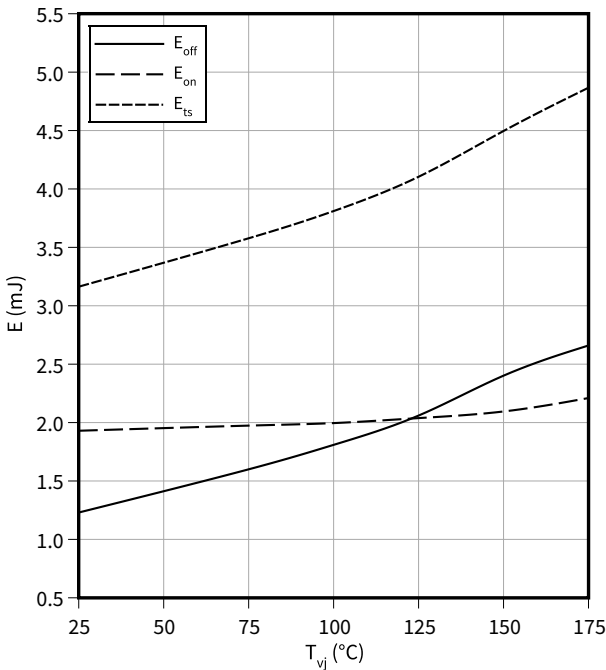
$I_C = 40\text{ A}$ ,  $V_{CC} = 600\text{ V}$ ,  $T_{vj} = 175\text{ }^\circ\text{C}$ ,  $V_{GE} = 0/15\text{ V}$



**Typical switching energy losses as a function of junction temperature**

$E = f(T_{vj})$

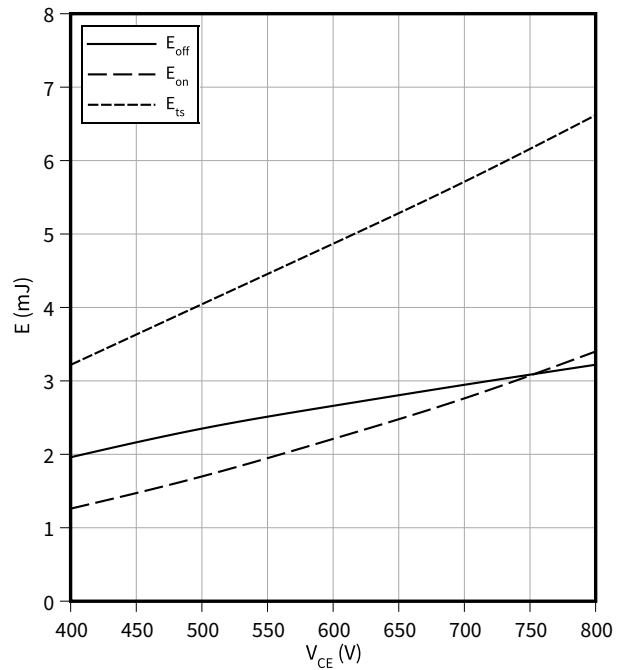
$I_C = 40\text{ A}$ ,  $V_{CC} = 600\text{ V}$ ,  $V_{GE} = 0/15\text{ V}$ ,  $R_G = 12\text{ }\Omega$



**Typical switching energy losses as a function of collector emitter voltage**

$E = f(V_{CE})$

$I_C = 40\text{ A}$ ,  $T_{vj} = 175\text{ }^\circ\text{C}$ ,  $V_{GE} = 0/15\text{ V}$ ,  $R_G = 12\text{ }\Omega$

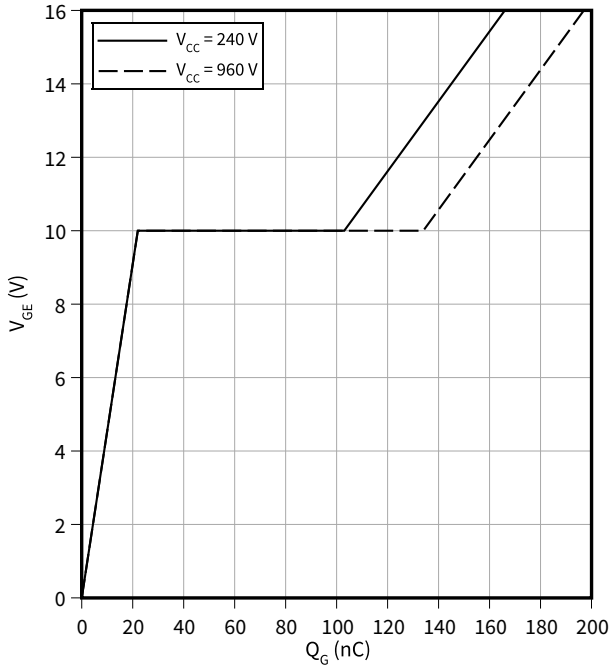


**2 Characteristics diagrams**

**Typical gate charge**

$V_{GE} = f(Q_G)$

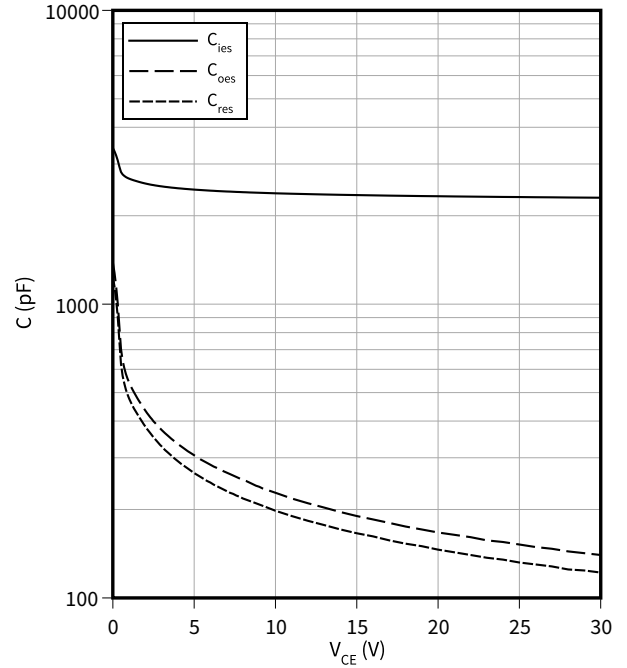
$I_C = 40 \text{ A}$



**Typical capacitance as a function of collector-emitter voltage**

$C = f(V_{CE})$

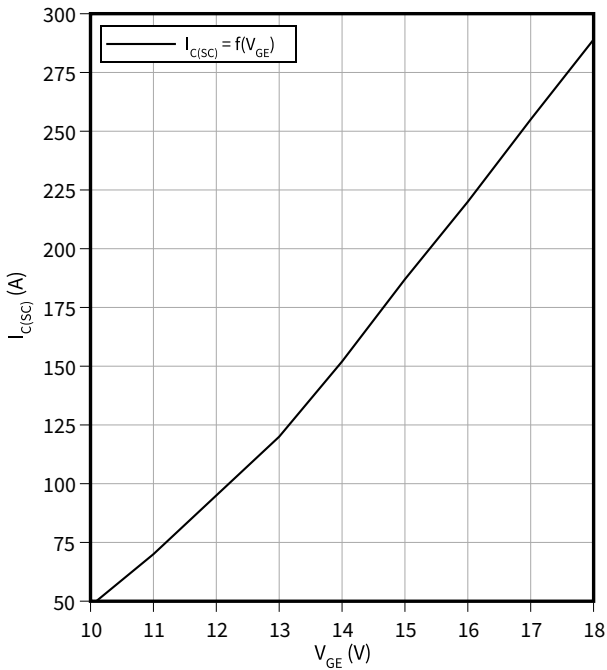
$f = 1000 \text{ kHz}, V_{GE} = 0 \text{ V}$



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

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

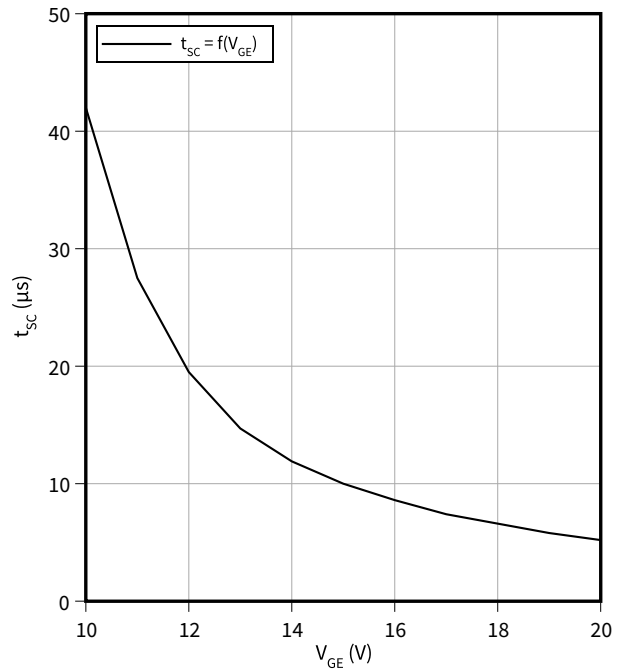
$T_{vj, start} = 25 \text{ }^\circ\text{C}, V_{CC} \leq 600 \text{ V}$



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

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

$T_{vj, start} \leq 150 \text{ }^\circ\text{C}, V_{CC} \leq 600 \text{ V}$

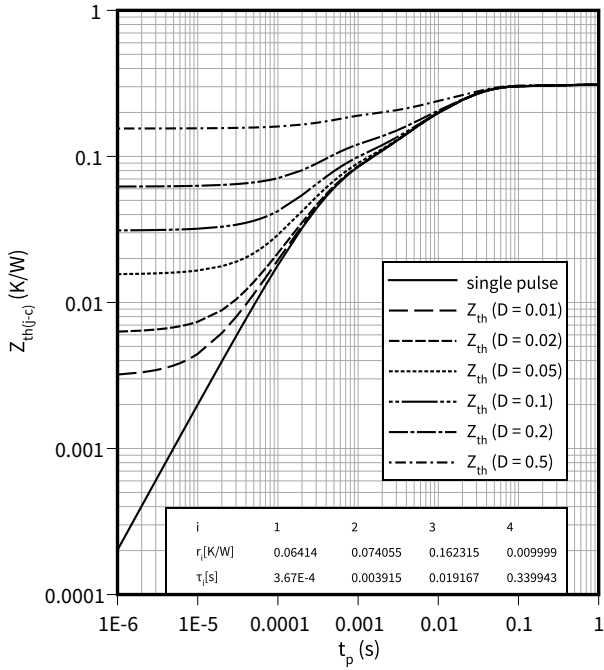


2 Characteristics diagrams

**IGBT transient thermal impedance as a function of pulse width**

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

$$D = t_p/T$$



## 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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**Document reference**

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