

## IGBT

Low  $V_{CE(sat)}$  IGBT in TRENCHSTOP™ 5 technology

## IGW30N65L5

650V IGBT Low  $V_{CE(sat)}$  series fifth generation

Data sheet

Industrial Power Control

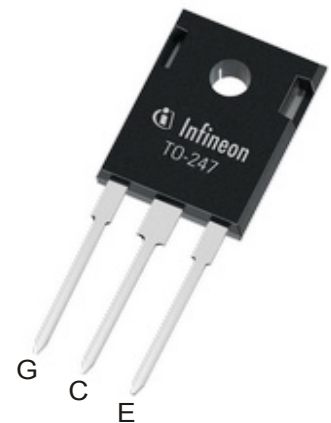
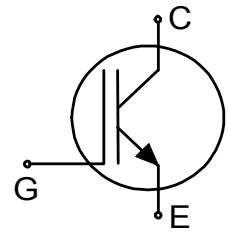
Low  $V_{CE(sat)}$  series fifth generation

Low  $V_{CE(sat)}$  IGBT in TRENCHSTOP™ 5 technology

#### Features and Benefits:

Low  $V_{CE(sat)}$  L5 technology offering

- Very low collector-emitter saturation voltage  $V_{CE(sat)}$
- Best-in-Class tradeoff between conduction and switching losses
- 650V breakdown voltage
- Low gate charge  $Q_G$
- Maximum junction temperature 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/>



#### Applications:

- Uninterruptible power supplies
- Solar photovoltaic inverters
- Welding machines

#### Product Validation:

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



#### Key Performance and Package Parameters

Type	$V_{CE}$	$I_C$	$V_{CE(sat)}$ , $T_{vj}=25^\circ\text{C}$	$T_{vjmax}$	Marking	Package
IGW30N65L5	650V	30A	1.05V	175°C	G30EL5	PG-TO247-3

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## Maximum Ratings

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

Parameter	Symbol	Value	Unit
Collector-emitter voltage, $T_{vj} \geq 25^\circ\text{C}$	$V_{CE}$	650	V
DC collector current, limited by $T_{vjmax}$ $T_c = 25^\circ\text{C}$ value limited by bondwire $T_c = 100^\circ\text{C}$	$I_C$	85.0 62.0	A
Pulsed collector current, $t_p$ limited by $T_{vjmax}^{(1)}$	$I_{Cpuls}$	120.0	A
Turn off safe operating area $V_{CE} \leq 650\text{V}$ , $T_{vj} \leq 175^\circ\text{C}$ , $t_p = 1\mu\text{s}^{(1)}$	-	120.0	A
Gate-emitter voltage Transient Gate-emitter voltage ( $t_p \leq 10\mu\text{s}$ , $D < 0.010$ )	$V_{GE}$	$\pm 20$ $\pm 30$	V
Power dissipation $T_c = 25^\circ\text{C}$ Power dissipation $T_c = 100^\circ\text{C}$	$P_{tot}$	227.0 114.0	W
Operating junction temperature	$T_{vj}$	-40...+175	$^\circ\text{C}$
Storage temperature	$T_{stg}$	-55...+150	$^\circ\text{C}$
Soldering temperature, <sup>(2)</sup> wave soldering 1.6mm (0.063in.) from case for 10s		260	$^\circ\text{C}$
Mounting torque, M3 screw Maximum of mounting processes: 3	$M$	0.6	Nm

## Thermal Resistance

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b><math>R_{th}</math> Characteristics</b>						
IGBT thermal resistance, junction - case	$R_{th(j-c)}$		-	-	0.66	K/W
Thermal resistance junction - ambient	$R_{th(j-a)}$		-	-	40	K/W

Electrical Characteristic, at  $T_{vj} = 25^\circ\text{C}$ , unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>Static Characteristic</b>						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0\text{V}$ , $I_C = 0.20\text{mA}$	650	-	-	V
Collector-emitter saturation voltage	$V_{CEsat}$	$V_{GE} = 15.0\text{V}$ , $I_C = 30.0\text{A}$ $T_{vj} = 25^\circ\text{C}$ $T_{vj} = 100^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$	- - -	1.05 1.05 1.04	1.35 - -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C = 0.40\text{mA}$ , $V_{CE} = 20\text{V}$	4.2	5.0	5.8	V
Zero gate voltage collector current	$I_{CES}$	$V_{CE} = 650\text{V}$ , $V_{GE} = 0\text{V}$ $T_{vj} = 25^\circ\text{C}$ $T_{vj} = 150^\circ\text{C}$ $T_{vj} = 175^\circ\text{C}$	- - -	- 400 2000	40 - -	$\mu\text{A}$
Gate-emitter leakage current	$I_{GES}$	$V_{CE} = 0\text{V}$ , $V_{GE} = 20\text{V}$	-	-	100	nA
Transconductance	$g_{fs}$	$V_{CE} = 20\text{V}$ , $I_C = 30.0\text{A}$	-	65.0	-	S

<sup>1)</sup> Defined by design. Not subject to production test.<sup>2)</sup> Package not recommended for surface mount applications.

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

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>Dynamic Characteristic</b>						
Input capacitance	$C_{ies}$	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$ $f = 1000\text{kHz}$	-	4900	-	pF
Output capacitance	$C_{oes}$		-	42	-	
Reverse transfer capacitance	$C_{res}$		-	18	-	
Gate charge	$Q_G$	$V_{CC} = 520\text{V}, I_C = 30.0\text{A},$ $V_{GE} = 15\text{V}$	-	168.0	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	$L_E$		-	13.0	-	nH

**Switching Characteristic, Inductive Load**

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>IGBT Characteristic, at <math>T_{vj} = 25^{\circ}\text{C}</math></b>						
Turn-on delay time	$t_{d(on)}$	$T_{vj} = 25^{\circ}\text{C},$ $V_{CC} = 400\text{V}, I_C = 30.0\text{A},$ $V_{GE} = 0.0/15.0\text{V},$ $R_{G(on)} = 10.0\Omega, R_{G(off)} = 10.0\Omega,$ $L\sigma = 60\text{nH}, C\sigma = 30\text{pF}$ $L\sigma, C\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery. Diode: IDW30E65D1.	-	33	-	ns
Rise time	$t_r$		-	11	-	ns
Turn-off delay time	$t_{d(off)}$		-	308	-	ns
Fall time	$t_f$		-	51	-	ns
Turn-on energy	$E_{on}$		-	0.47	-	mJ
Turn-off energy	$E_{off}$		-	1.35	-	mJ
Total switching energy	$E_{ts}$		-	1.82	-	mJ

**Switching Characteristic, Inductive Load**

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>IGBT Characteristic, at <math>T_{vj} = 150^{\circ}\text{C}</math></b>						
Turn-on delay time	$t_{d(on)}$	$T_{vj} = 150^{\circ}\text{C},$ $V_{CC} = 400\text{V}, I_C = 30.0\text{A},$ $V_{GE} = 0.0/15.0\text{V},$ $R_{G(on)} = 10.0\Omega, R_{G(off)} = 10.0\Omega,$ $L\sigma = 60\text{nH}, C\sigma = 30\text{pF}$ $L\sigma, C\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery. Diode: IDW30E65D1.	-	31	-	ns
Rise time	$t_r$		-	13	-	ns
Turn-off delay time	$t_{d(off)}$		-	370	-	ns
Fall time	$t_f$		-	150	-	ns
Turn-on energy	$E_{on}$		-	0.68	-	mJ
Turn-off energy	$E_{off}$		-	2.18	-	mJ
Total switching energy	$E_{ts}$		-	2.86	-	mJ

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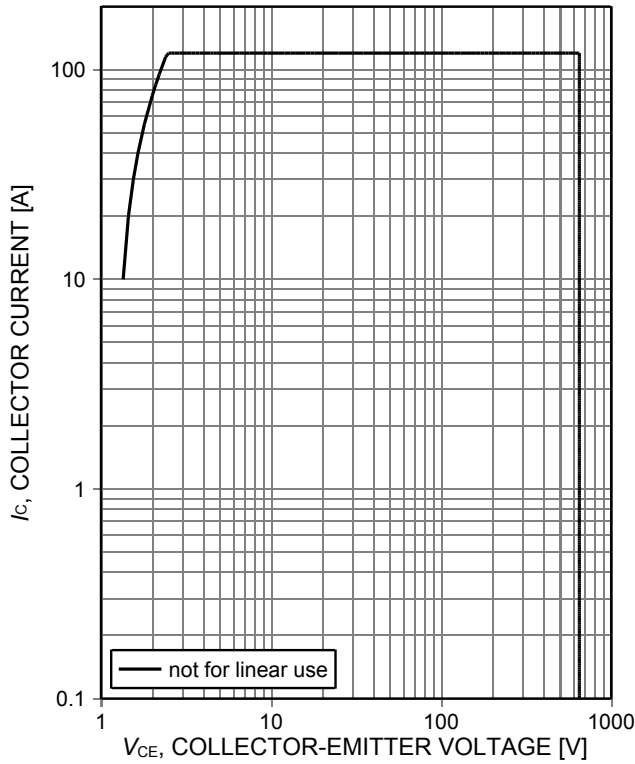


Figure 1. **Forward bias safe operating area**  
 ( $D=0$ ,  $T_C=25^\circ\text{C}$ ,  $T_{vj}\leq 175^\circ\text{C}$ ,  $V_{GE}=15\text{V}$ ,  $t_p=1\mu\text{s}$ ,  
 $I_{Cmax}$  defined by design - not subject to production test)

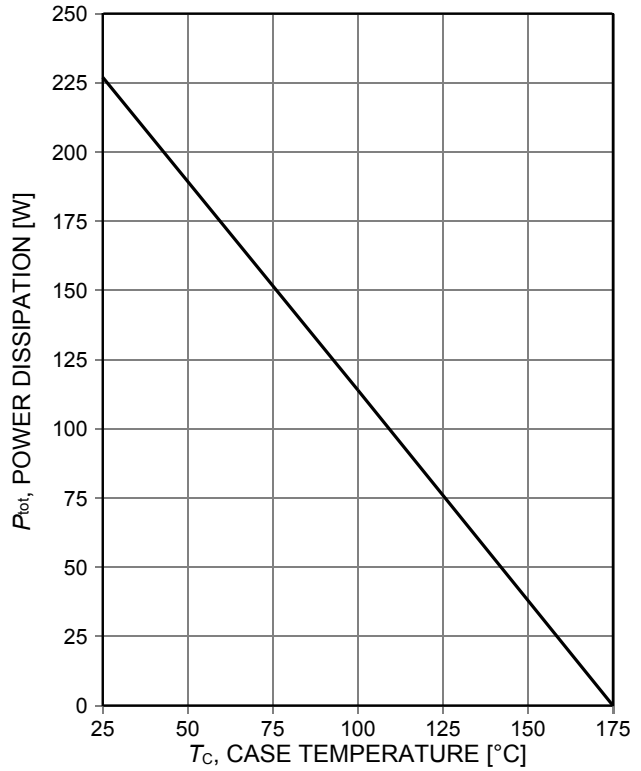


Figure 2. **Power dissipation as a function of case temperature**  
 ( $T_{vj}\leq 175^\circ\text{C}$ )

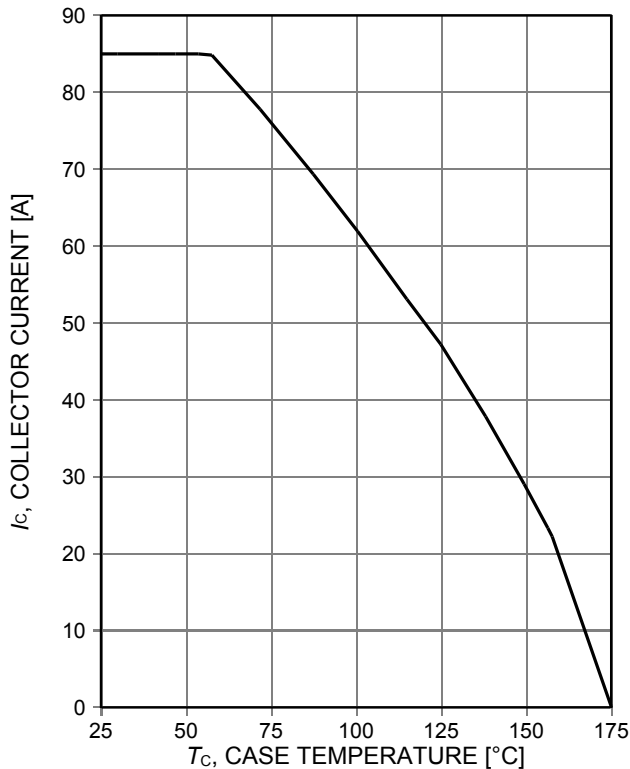


Figure 3. **Collector current as a function of case temperature**  
 ( $V_{GE}\geq 15\text{V}$ ,  $T_{vj}\leq 175^\circ\text{C}$ )

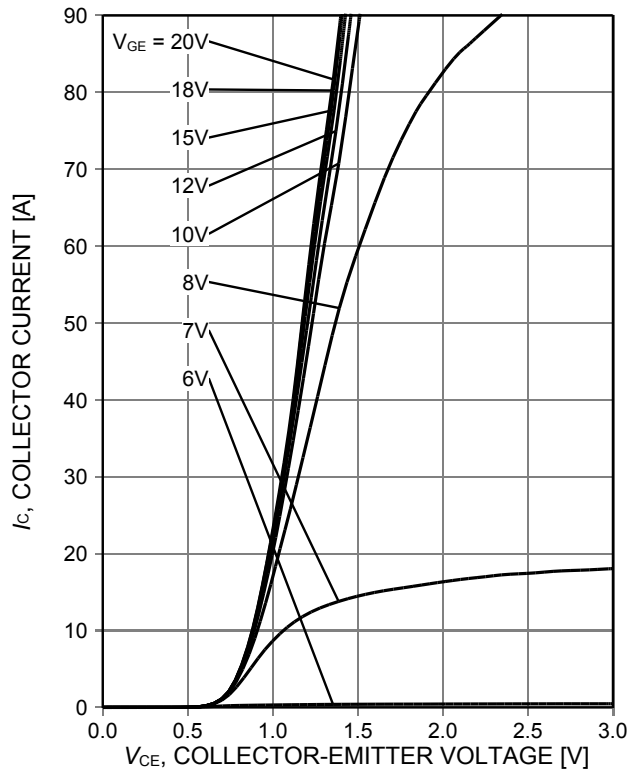


Figure 4. **Typical output characteristic**  
 ( $T_{vj}=25^\circ\text{C}$ )

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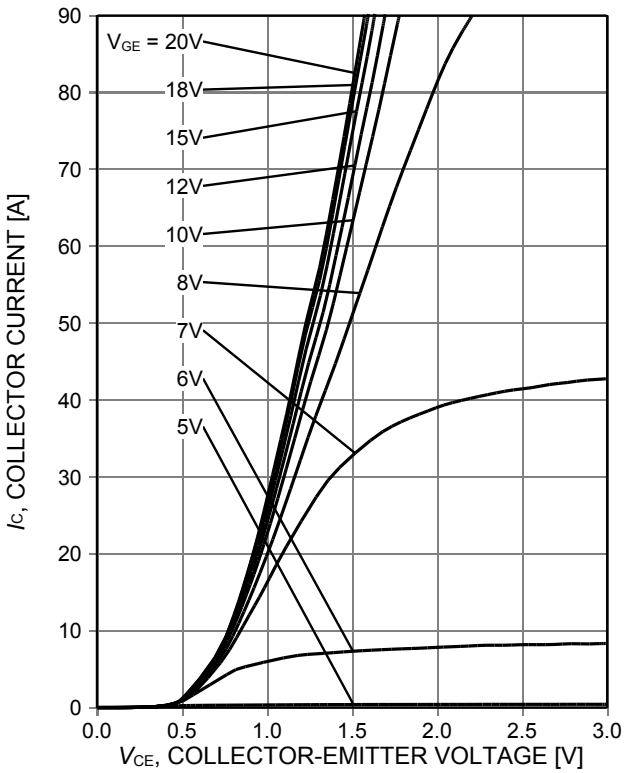


Figure 5. **Typical output characteristic**  
( $T_{vj}=175^{\circ}\text{C}$ )

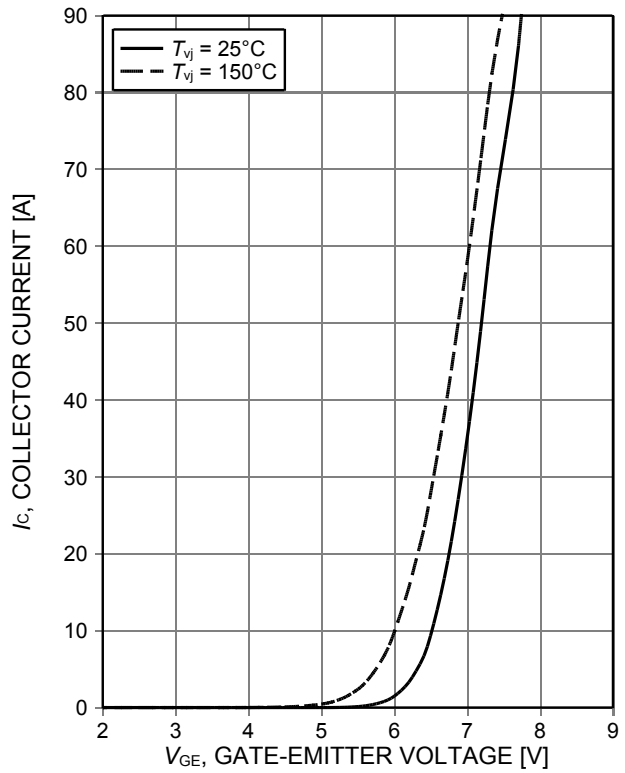


Figure 6. **Typical transfer characteristic**  
( $V_{CE}=20\text{V}$ )

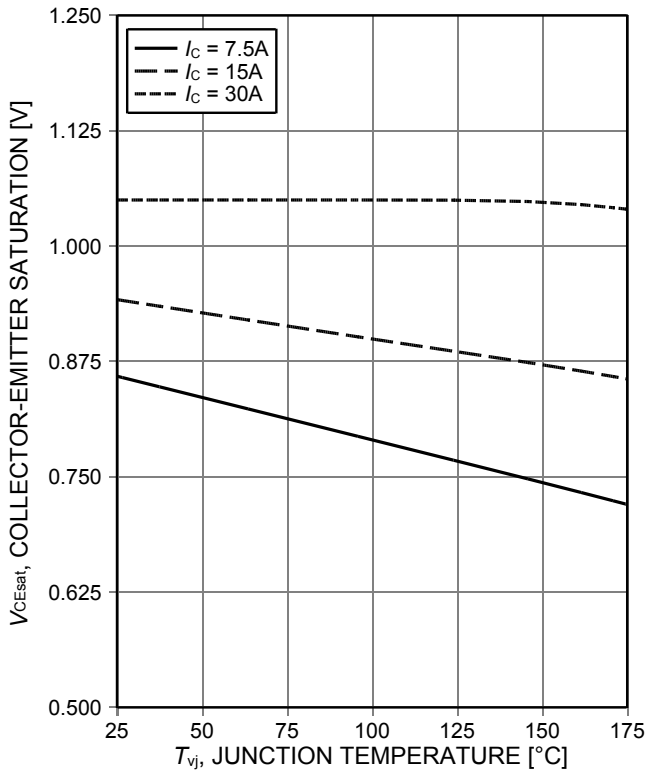


Figure 7. **Typical collector-emitter saturation voltage as a function of junction temperature**  
( $V_{GE}=15\text{V}$ )

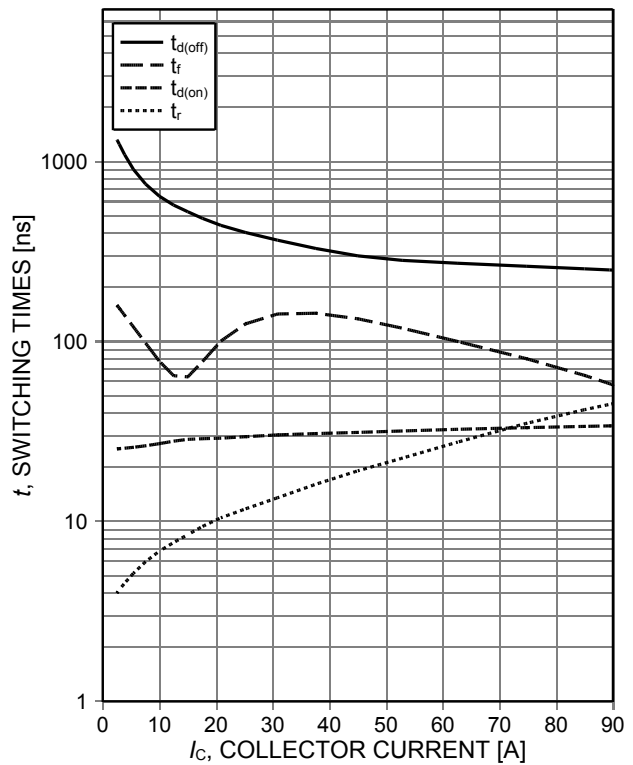


Figure 8. **Typical switching times as a function of collector current**  
(inductive load,  $T_{vj}=150^{\circ}\text{C}$ ,  $V_{CE}=400\text{V}$ ,  $V_{GE}=0/15\text{V}$ ,  $R_{G(on)}=10\Omega$ ,  $R_{G(off)}=10\Omega$ , dynamic test circuit in Figure E)

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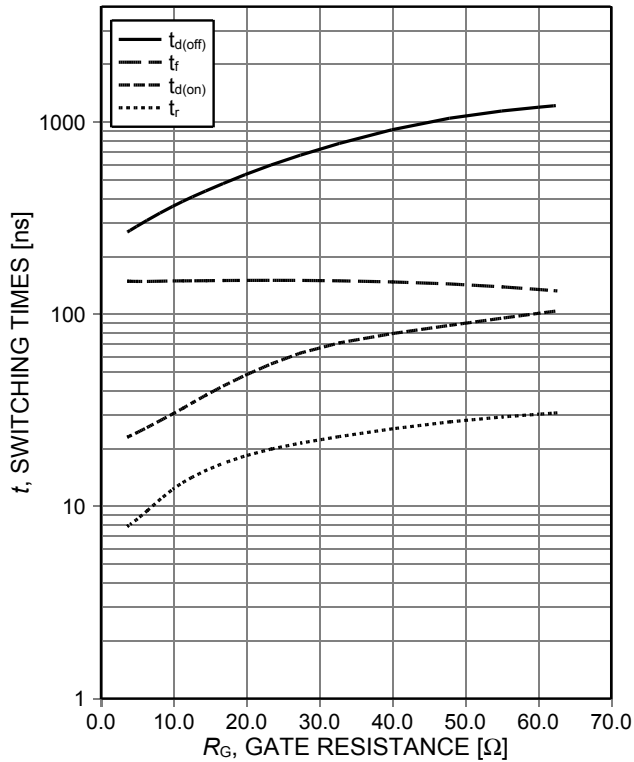


Figure 9. **Typical switching times as a function of gate resistance**  
 (inductive load,  $T_{vj}=150^{\circ}\text{C}$ ,  $V_{CE}=400\text{V}$ ,  $V_{GE}=0/15\text{V}$ ,  $I_C=30\text{A}$ , dynamic test circuit in Figure E)

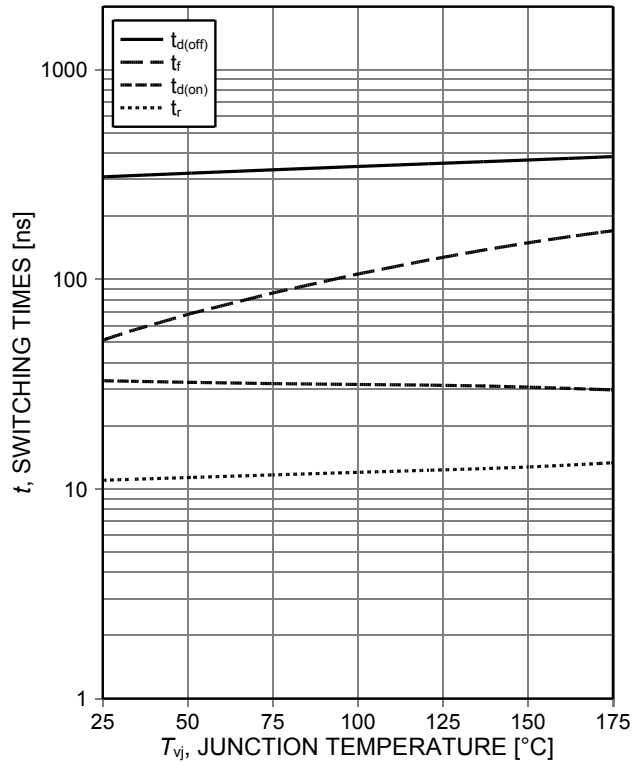


Figure 10. **Typical switching times as a function of junction temperature**  
 (inductive load,  $V_{CE}=400\text{V}$ ,  $V_{GE}=0/15\text{V}$ ,  $I_C=30\text{A}$ ,  $R_{G(on)}=10\Omega$ ,  $R_{G(off)}=10\Omega$ , dynamic test circuit in Figure E)

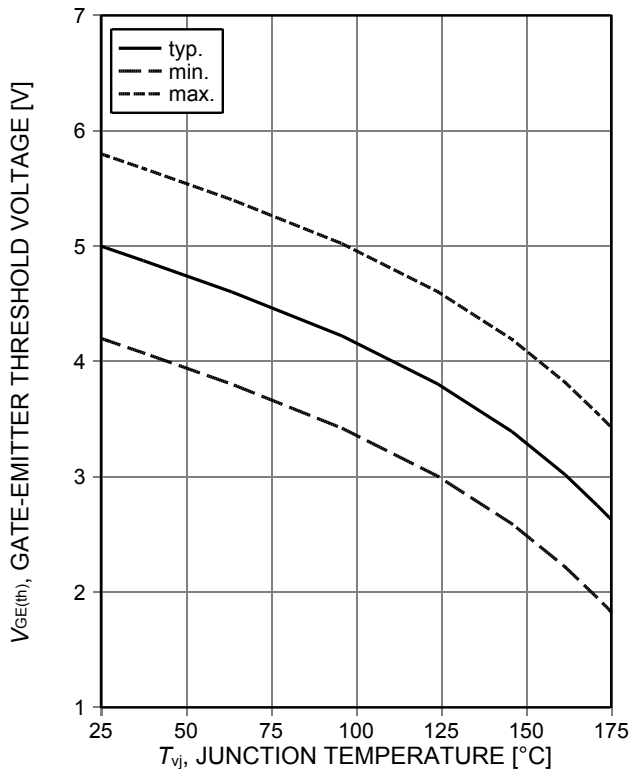


Figure 11. **Gate-emitter threshold voltage as a function of junction temperature**  
 ( $I_C=0.4\text{mA}$ )

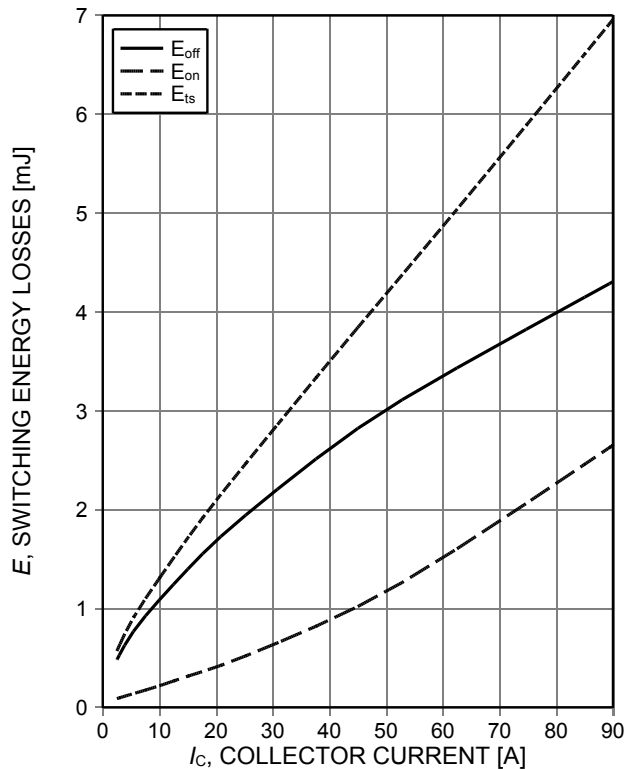


Figure 12. **Typical switching energy losses as a function of collector current**  
 (inductive load,  $T_{vj}=150^{\circ}\text{C}$ ,  $V_{CE}=400\text{V}$ ,  $V_{GE}=0/15\text{V}$ ,  $R_{G(on)}=10\Omega$ ,  $R_{G(off)}=10\Omega$ , dynamic test circuit in Figure E)

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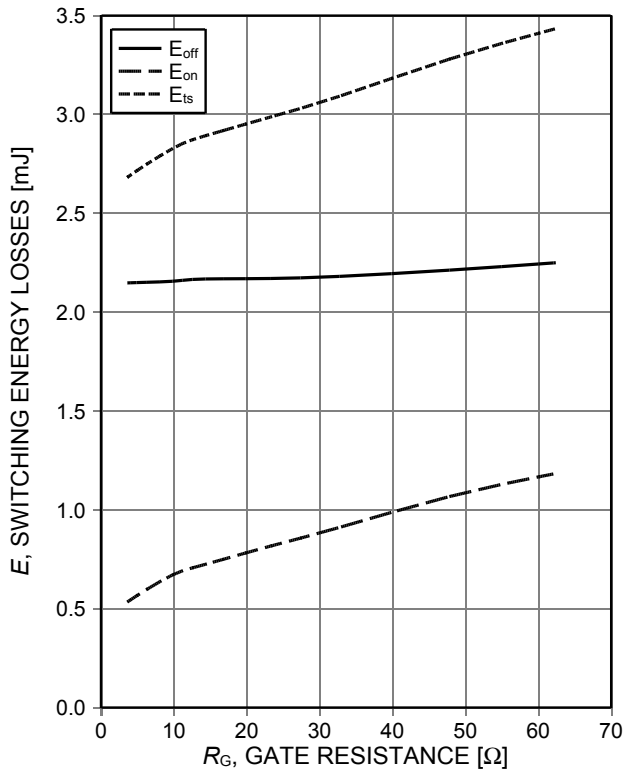


Figure 13. **Typical switching energy losses as a function of gate resistance**  
 (inductive load,  $T_{vj}=150^{\circ}\text{C}$ ,  $V_{CE}=400\text{V}$ ,  $V_{GE}=0/15\text{V}$ ,  $I_C=30\text{A}$ , dynamic test circuit in Figure E)

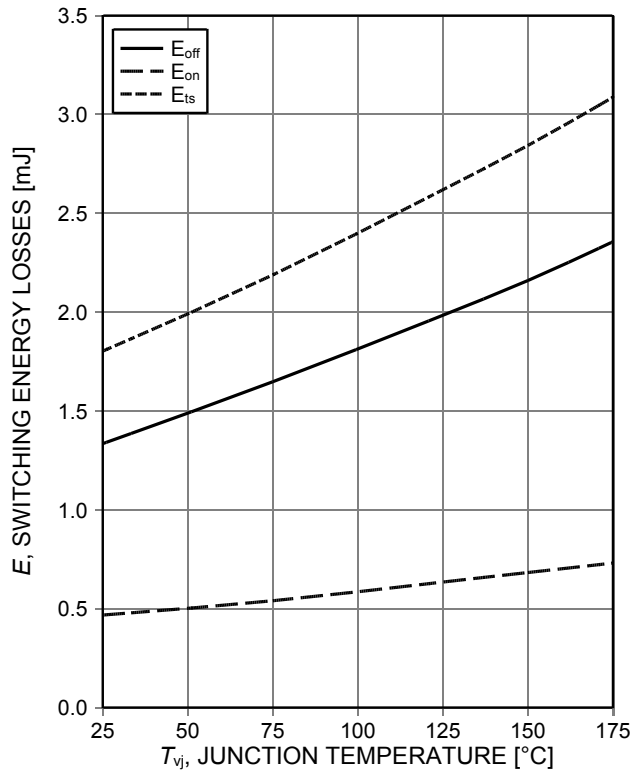


Figure 14. **Typical switching energy losses as a function of junction temperature**  
 (inductive load,  $V_{CE}=400\text{V}$ ,  $V_{GE}=0/15\text{V}$ ,  $I_C=30\text{A}$ ,  $R_{G(on)}=10\Omega$ ,  $R_{G(off)}=10\Omega$ , dynamic test circuit in Figure E)

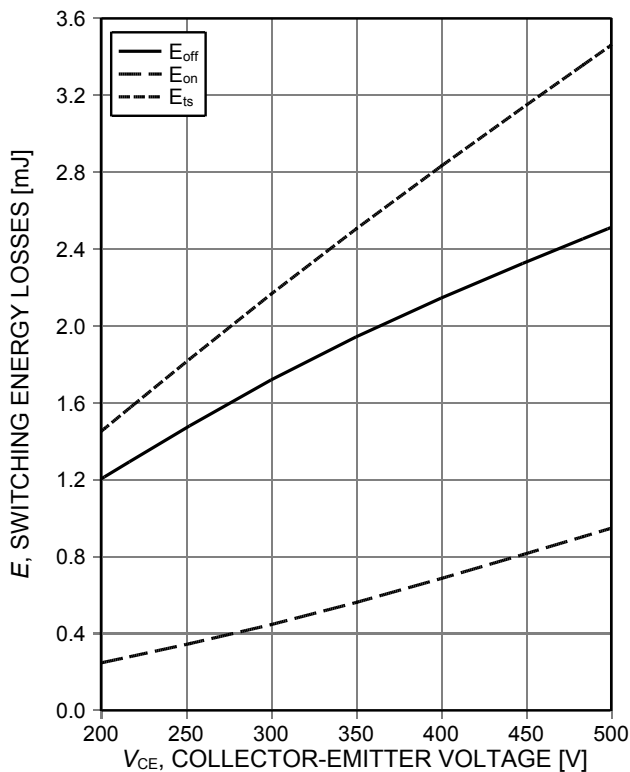


Figure 15. **Typical switching energy losses as a function of collector emitter voltage**  
 (inductive load,  $T_{vj}=150^{\circ}\text{C}$ ,  $V_{GE}=0/15\text{V}$ ,  $I_C=30\text{A}$ ,  $R_{G(on)}=10\Omega$ ,  $R_{G(off)}=10\Omega$ , dynamic test circuit in Figure E)

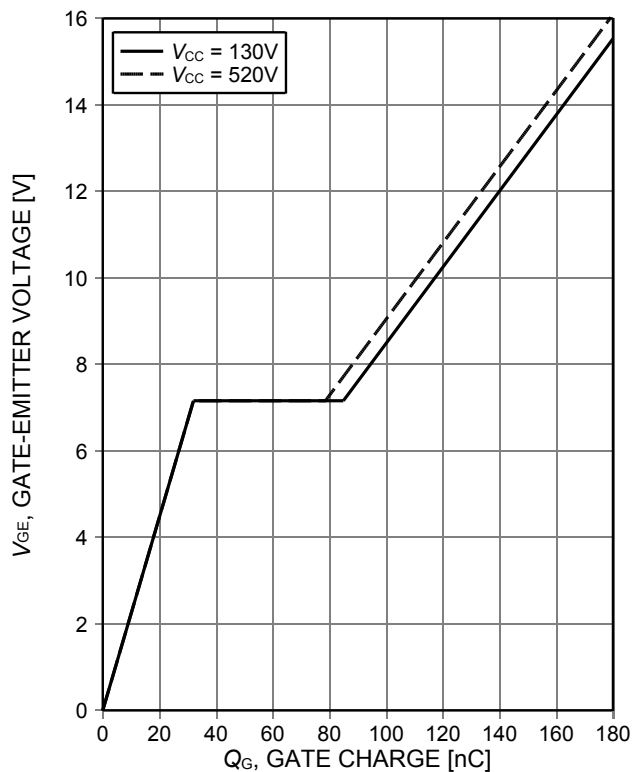


Figure 16. **Typical gate charge**  
 ( $I_C=30\text{A}$ )

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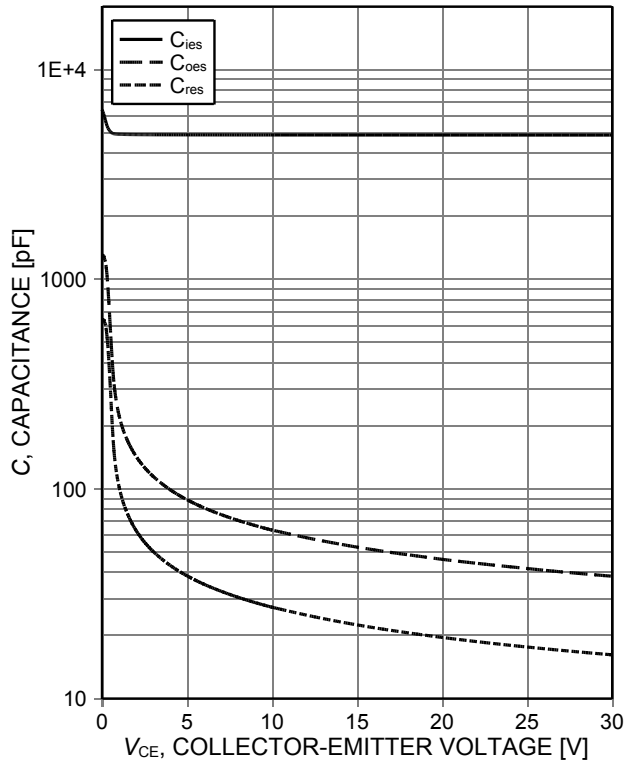


Figure 17. Typical capacitance as a function of collector-emitter voltage ( $V_{GE}=0V$ ,  $f=1MHz$ )

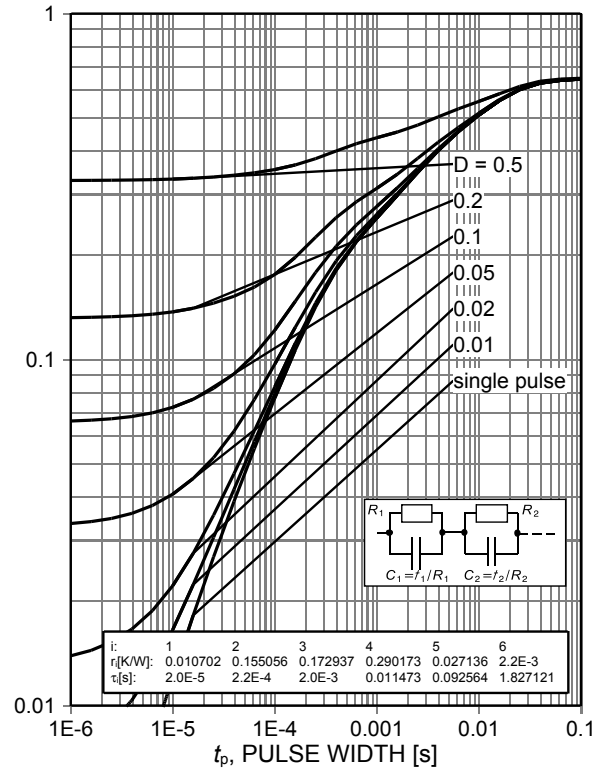
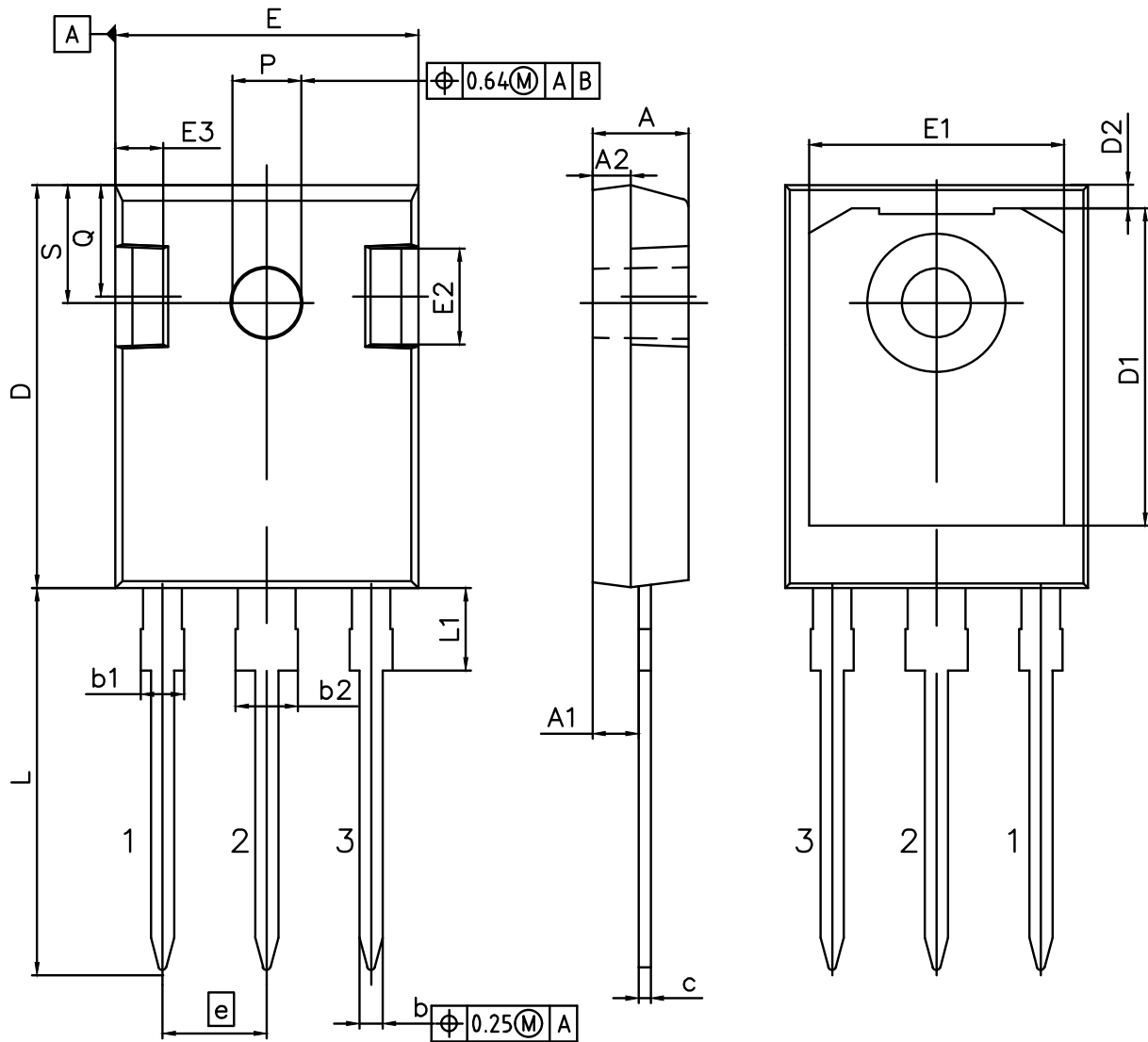


Figure 18. IGBT transient thermal impedance ( $D=t_p/T$ )

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**Package Drawing PG-TO247-3**



DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	4.70	5.30
A1	2.20	2.60
A2	1.50	2.50
b	1.00	1.40
b1	1.60	2.41
b2	2.57	3.43
c	0.38	0.89
D	20.70	21.50
D1	13.08	17.65
D2	0.51	1.35
E	15.50	16.30
E1	12.38	14.15
E2	3.40	5.10
E3	1.00	2.60
e	5.44	
L	19.80	20.40
L1	3.85	4.50
P	3.50	3.70
Q	5.35	6.25
S	6.04	6.30

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Testing Conditions

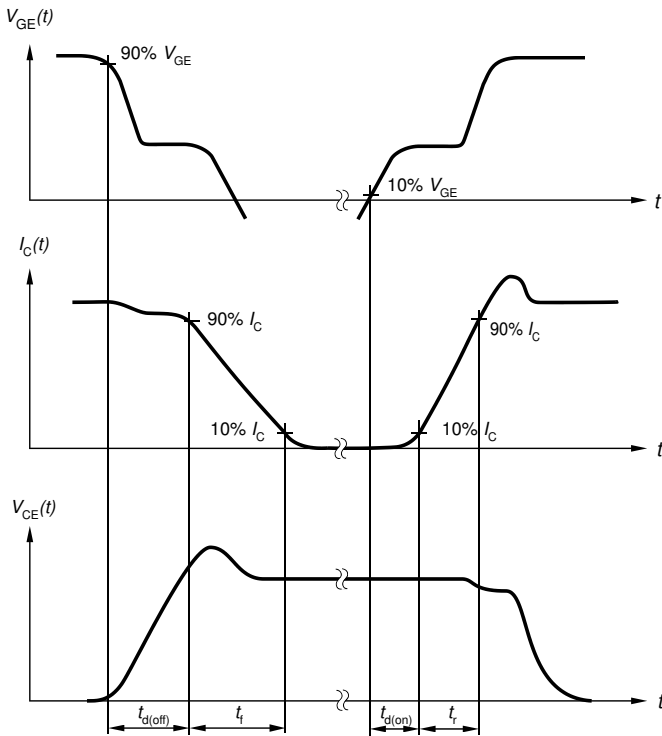


Figure A. Definition of switching times

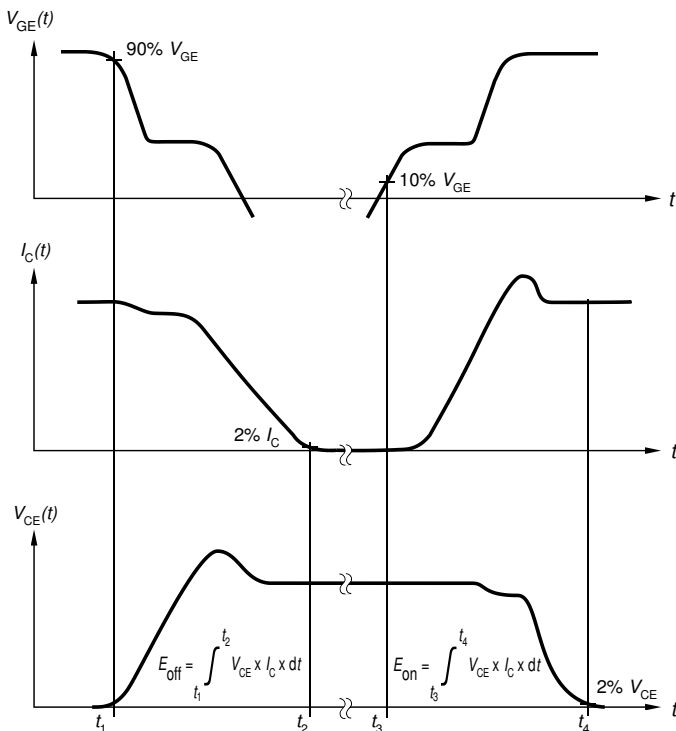


Figure B. Definition of switching losses

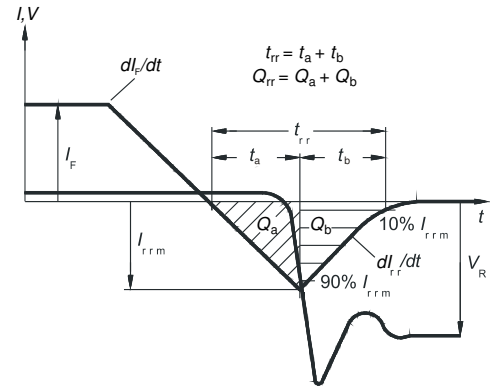


Figure C. Definition of diode switching characteristics

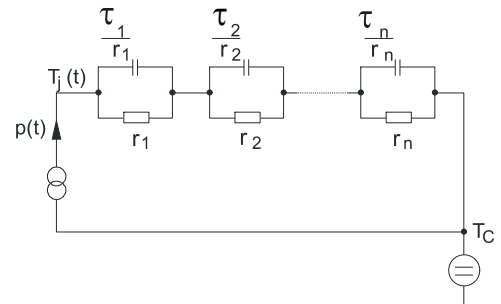


Figure D. Thermal equivalent circuit

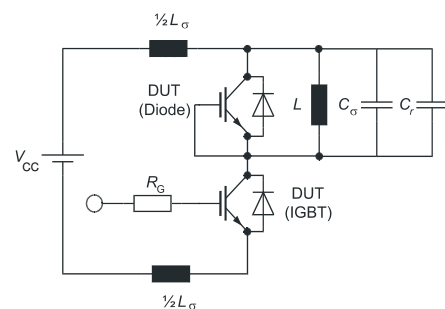


Figure E. Dynamic test circuit  
Parasitic inductance  $L_{\sigma}$ ,  
parasitic capacitor  $C_{\sigma}$ ,  
relief capacitor  $C_r$ ,  
(only for ZVT switching)

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Low  $V_{CE(sat)}$  series fifth generation

### Revision History

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IGW30N65L5

**Revision: 2020-10-07, Rev. 2.2**

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Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.1	2014-12-10	Final data sheet
2.2	2020-10-07	VGE(th): test condition update

## Trademarks

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