

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

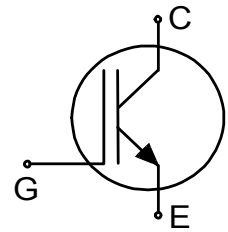
Low $V_{CE(sat)}$ series fifth generation

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/>

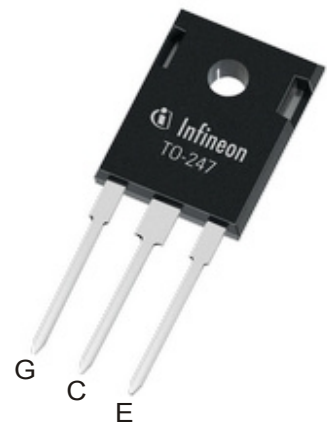


Applications:

- 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}	± 20 ± 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, ⁽²⁾ 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.	
R_{th} Characteristics						
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.	
Static Characteristic						
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 - -	μA
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

¹⁾ Defined by design. Not subject to production test.²⁾ 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.	
Dynamic Characteristic						
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.	
IGBT Characteristic, at $T_{vj} = 25^{\circ}\text{C}$						
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.	
IGBT Characteristic, at $T_{vj} = 150^{\circ}\text{C}$						
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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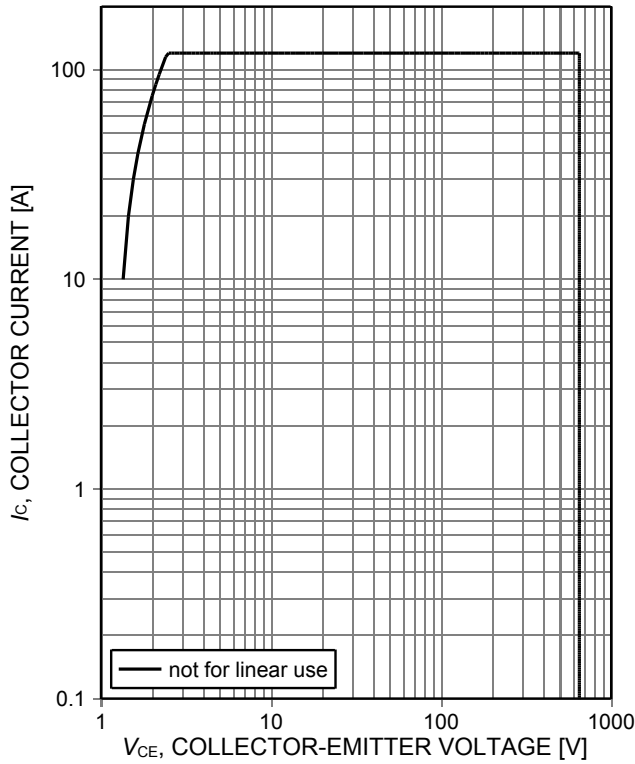


Figure 1. **Forward bias safe operating area**
 ($D=0$, $T_C=25^\circ\text{C}$, $T_{vj}\leq 175^\circ\text{C}$, $V_{GE}=15\text{V}$, $t_p=1\mu\text{s}$,
 I_{Cmax} defined by design - not subject to production test)

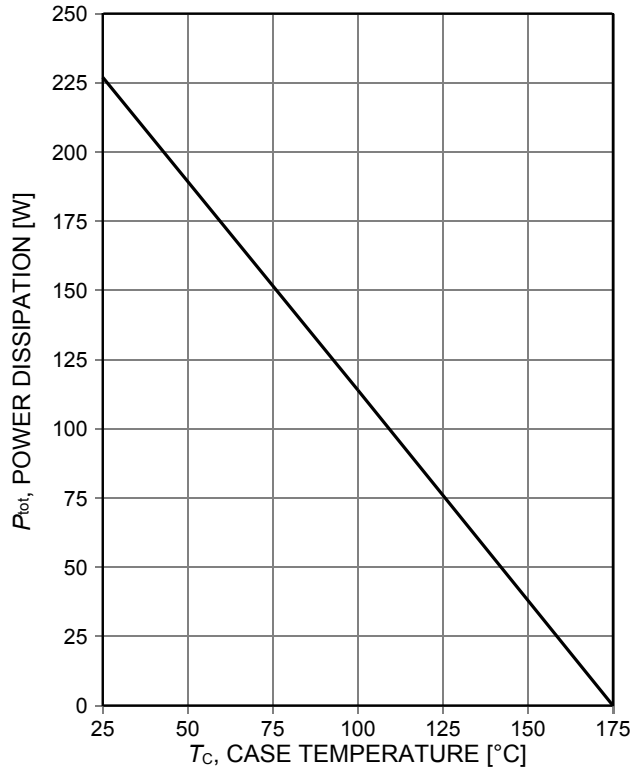


Figure 2. **Power dissipation as a function of case temperature**
 ($T_{vj}\leq 175^\circ\text{C}$)

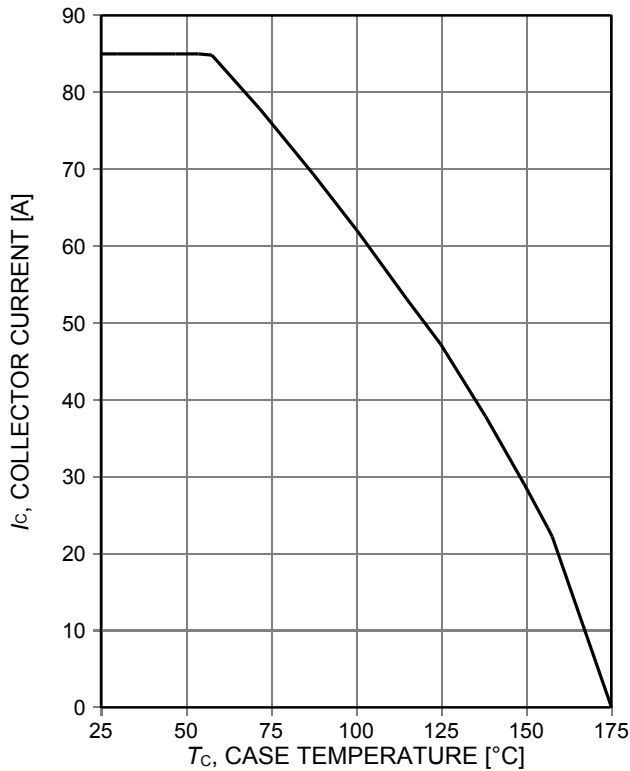


Figure 3. **Collector current as a function of case temperature**
 ($V_{GE}\geq 15\text{V}$, $T_{vj}\leq 175^\circ\text{C}$)

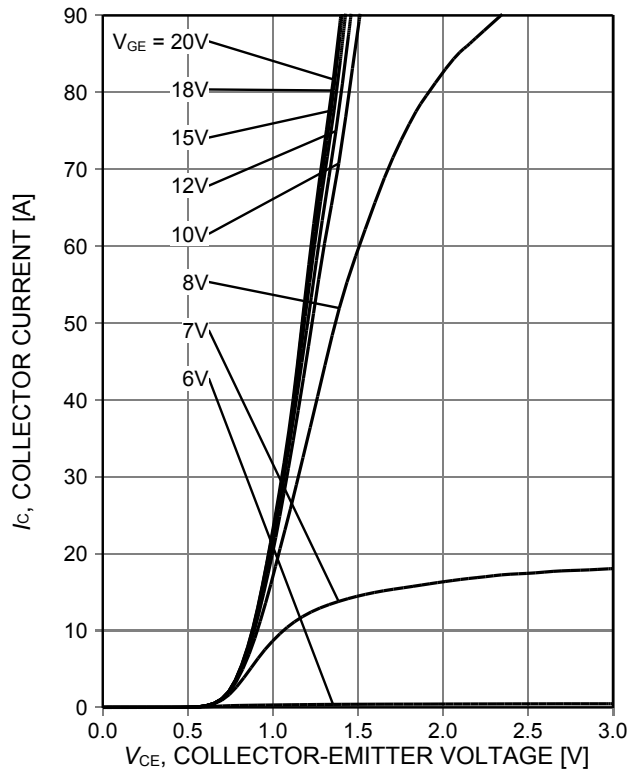


Figure 4. **Typical output characteristic**
 ($T_{vj}=25^\circ\text{C}$)

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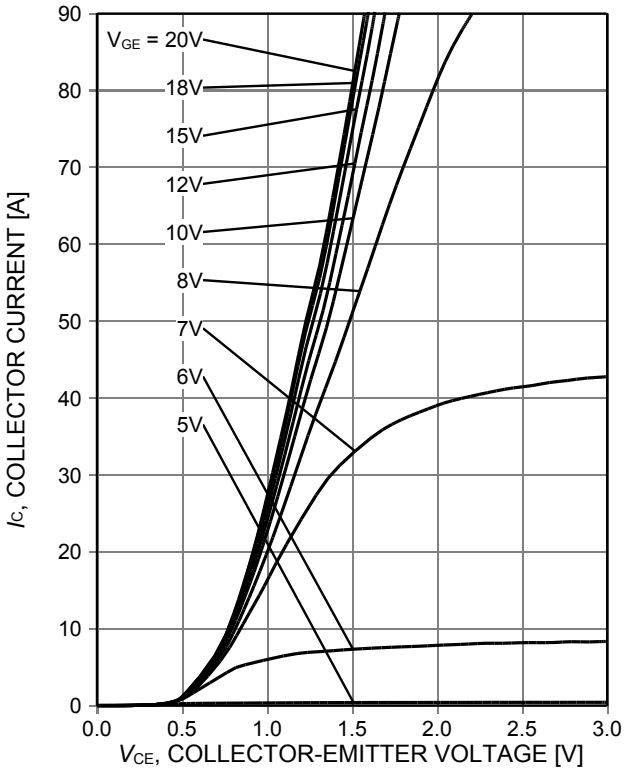


Figure 5. **Typical output characteristic**
($T_{vj}=175^{\circ}\text{C}$)

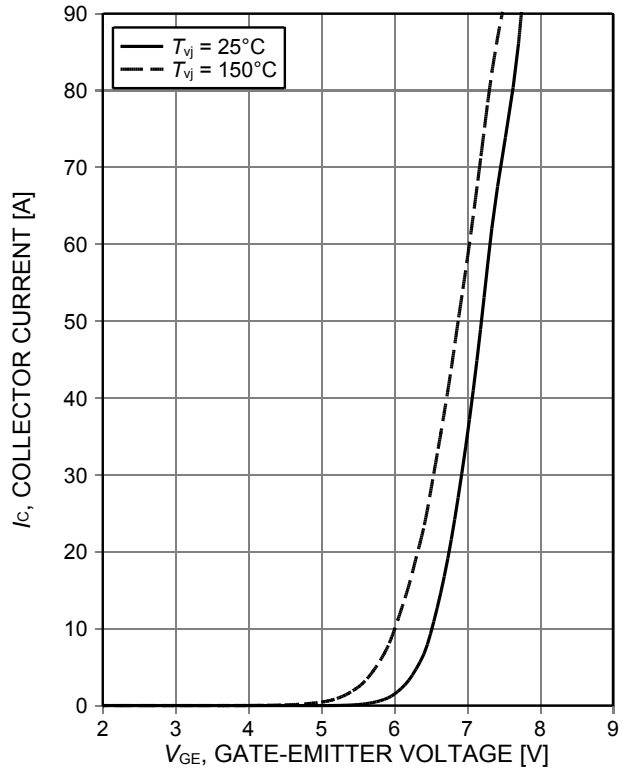


Figure 6. **Typical transfer characteristic**
($V_{CE}=20\text{V}$)

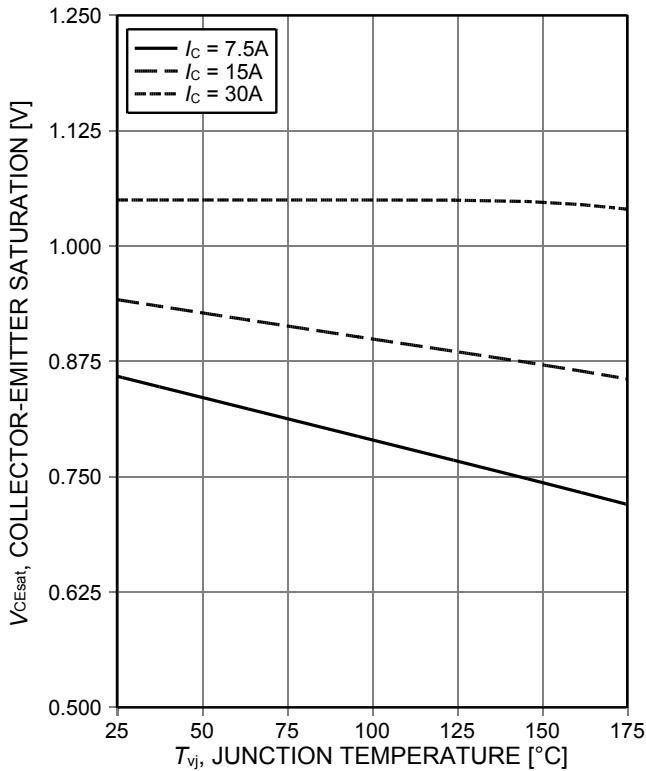


Figure 7. **Typical collector-emitter saturation voltage as a function of junction temperature**
($V_{GE}=15\text{V}$)

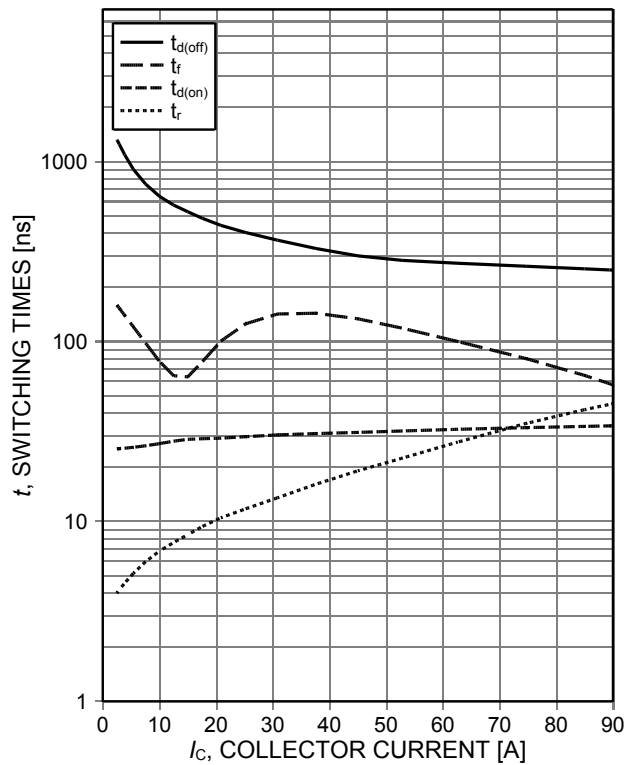


Figure 8. **Typical switching times as a function of collector current**
(inductive load, $T_{vj}=150^{\circ}\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $R_{G(on)}=10\Omega$, $R_{G(off)}=10\Omega$, dynamic test circuit in Figure E)

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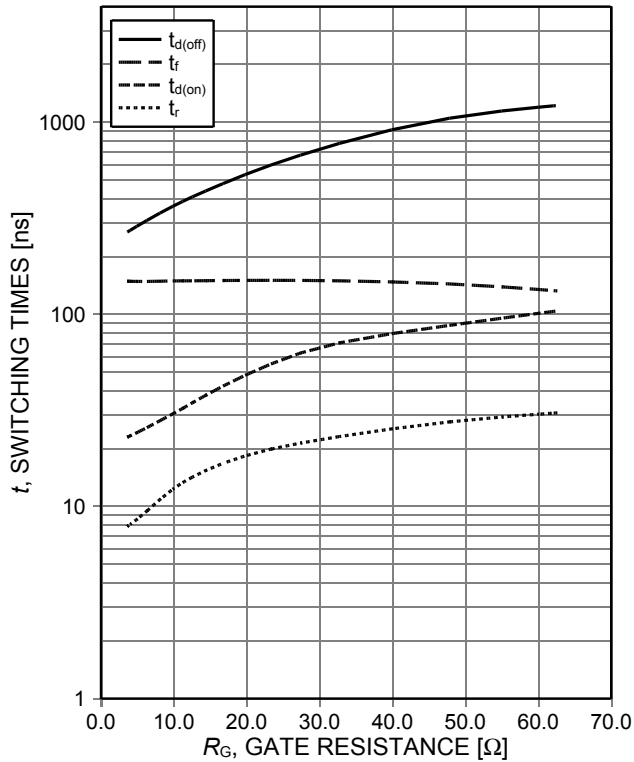


Figure 9. **Typical switching times as a function of gate resistance**
 (inductive load, $T_{vj}=150^{\circ}\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$, dynamic test circuit in Figure E)

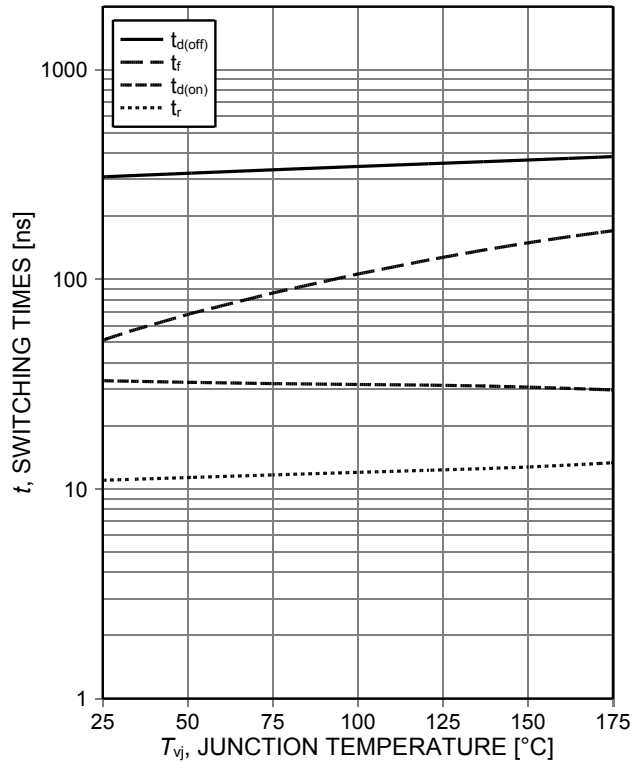


Figure 10. **Typical switching times as a function of junction temperature**
 (inductive load, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$, $R_{G(on)}=10\Omega$, $R_{G(off)}=10\Omega$, dynamic test circuit in Figure E)

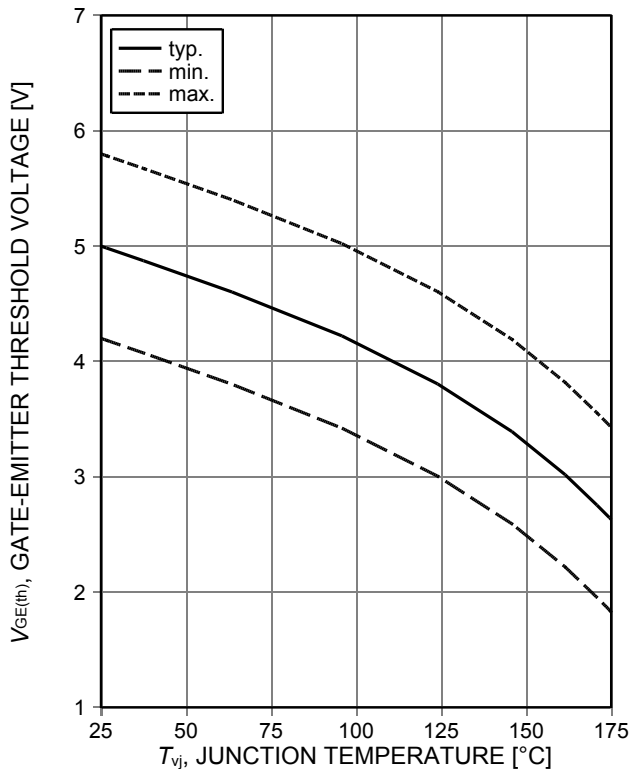


Figure 11. **Gate-emitter threshold voltage as a function of junction temperature**
 ($I_C=0.4\text{mA}$)

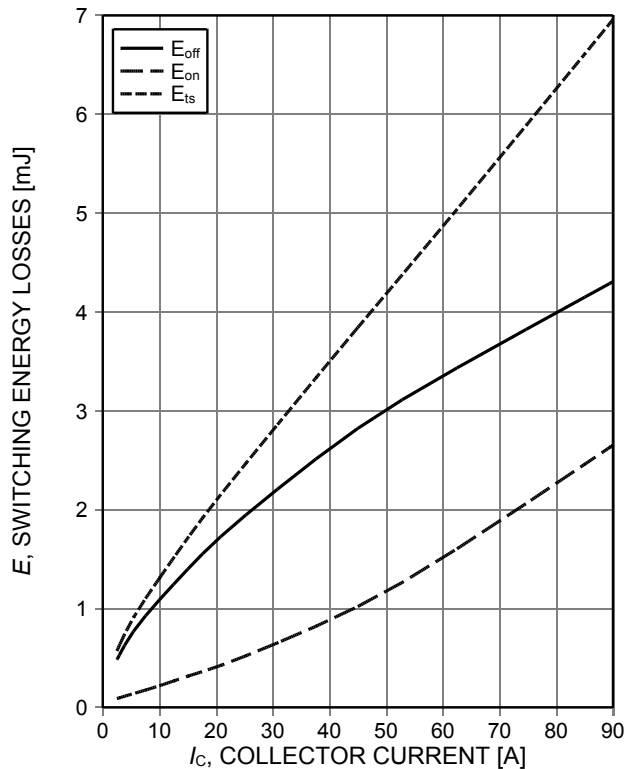


Figure 12. **Typical switching energy losses as a function of collector current**
 (inductive load, $T_{vj}=150^{\circ}\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $R_{G(on)}=10\Omega$, $R_{G(off)}=10\Omega$, dynamic test circuit in Figure E)

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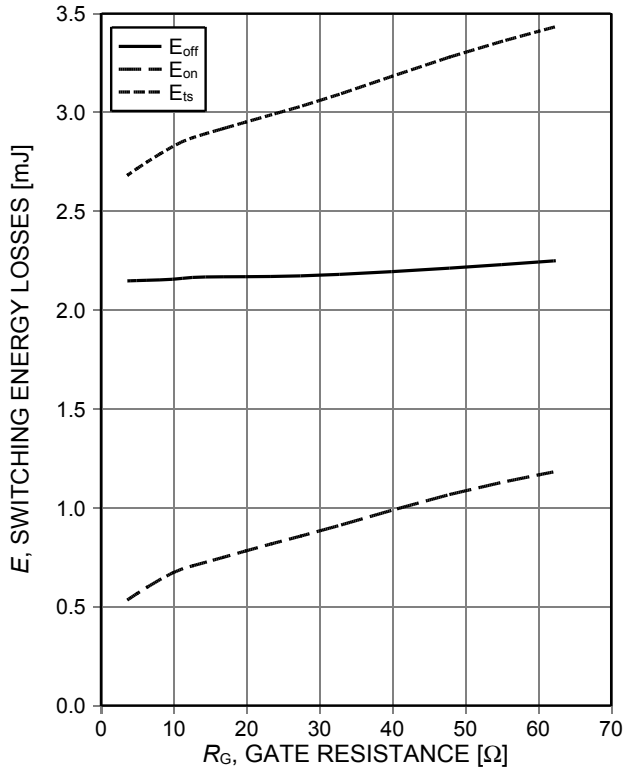


Figure 13. **Typical switching energy losses as a function of gate resistance**
 (inductive load, $T_{vj}=150^{\circ}\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$, dynamic test circuit in Figure E)

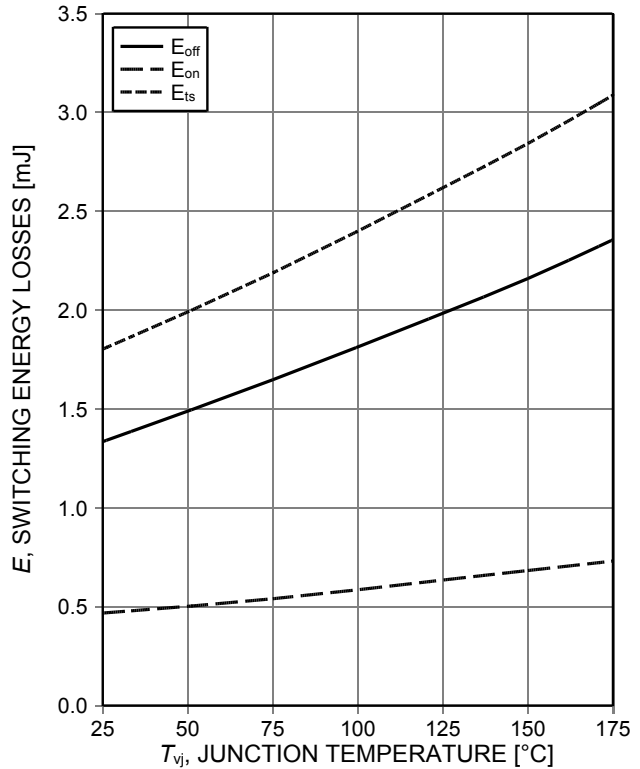


Figure 14. **Typical switching energy losses as a function of junction temperature**
 (inductive load, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$, $R_{G(on)}=10\Omega$, $R_{G(off)}=10\Omega$, dynamic test circuit in Figure E)

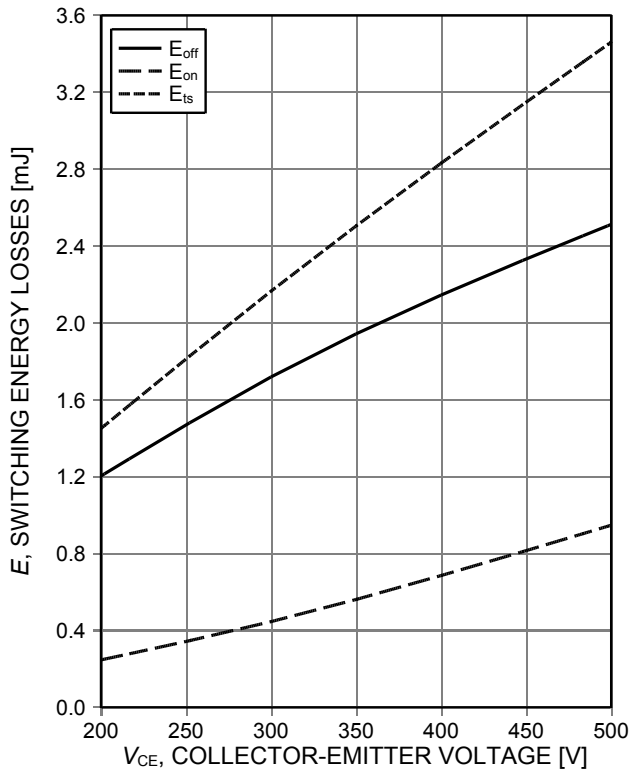


Figure 15. **Typical switching energy losses as a function of collector emitter voltage**
 (inductive load, $T_{vj}=150^{\circ}\text{C}$, $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$, $R_{G(on)}=10\Omega$, $R_{G(off)}=10\Omega$, dynamic test circuit in Figure E)

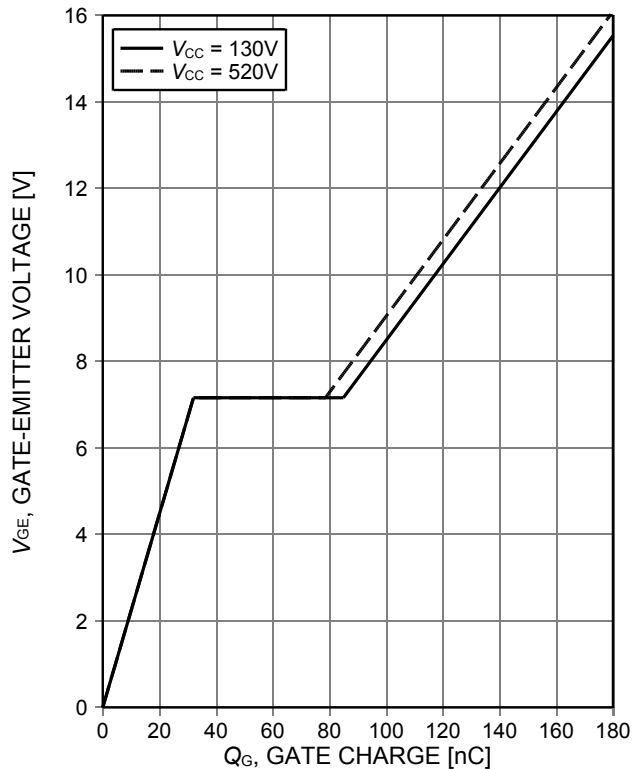


Figure 16. **Typical gate charge**
 ($I_C=30\text{A}$)

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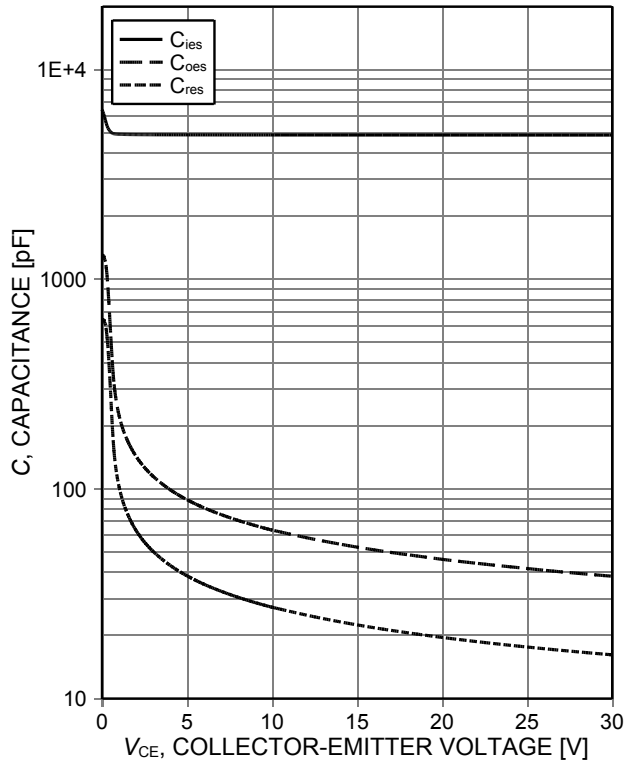


Figure 17. Typical capacitance as a function of collector-emitter voltage ($V_{GE}=0V$, $f=1MHz$)

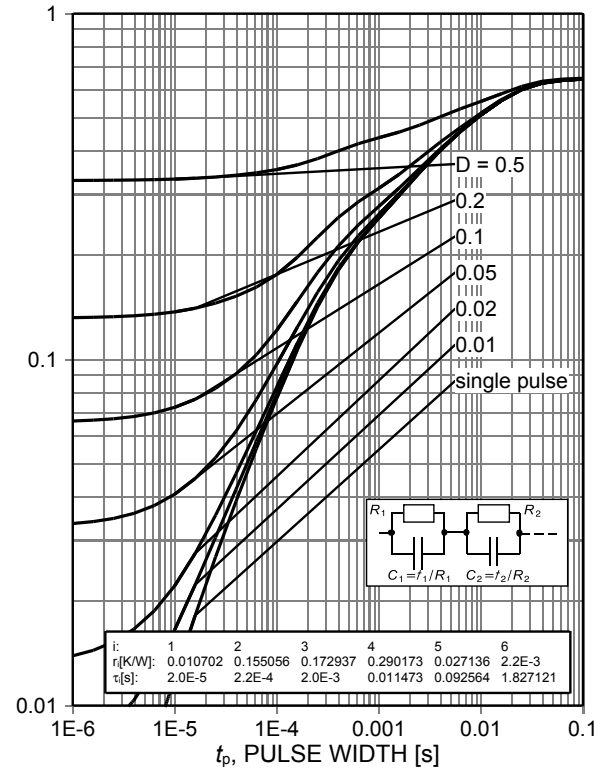
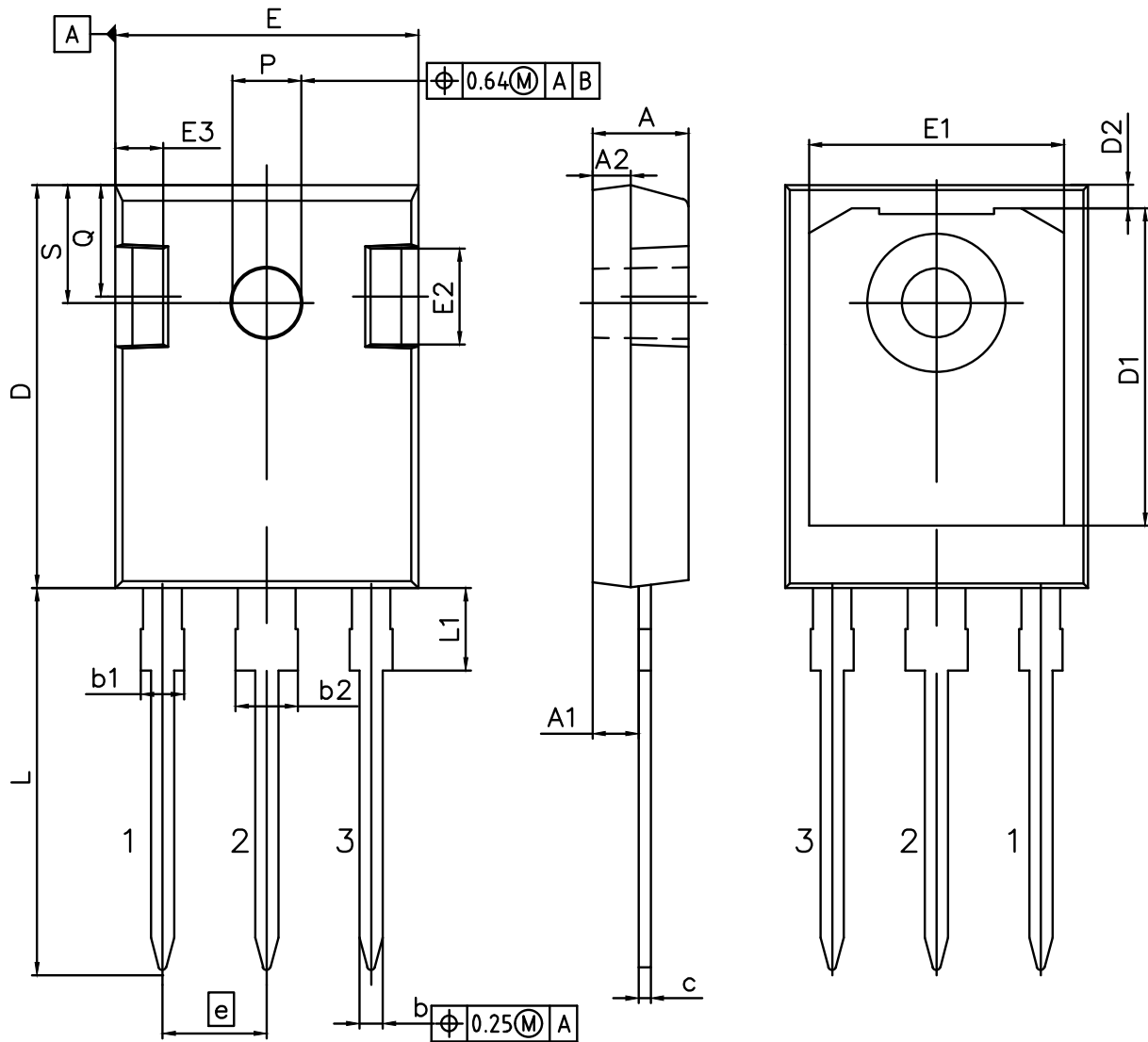


Figure 18. IGBT transient thermal impedance ($D=t_p/T$)

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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

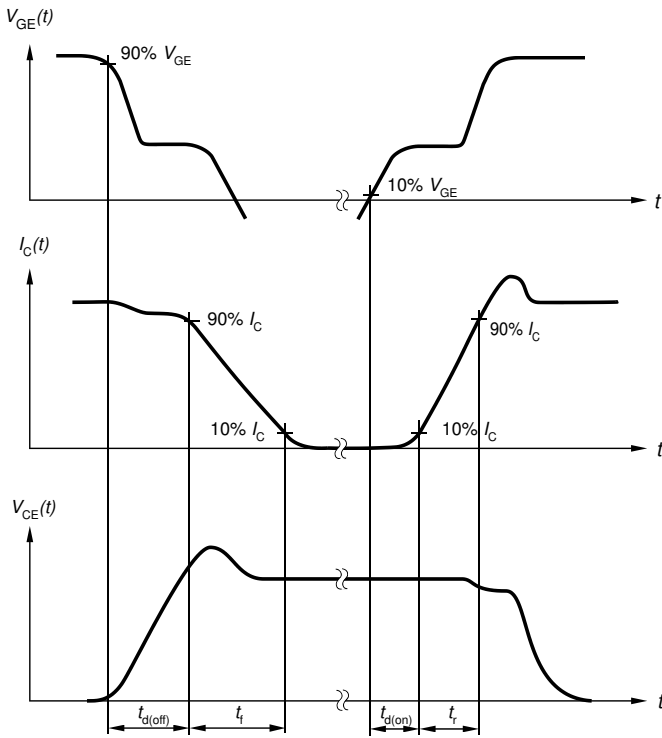


Figure A. Definition of switching times

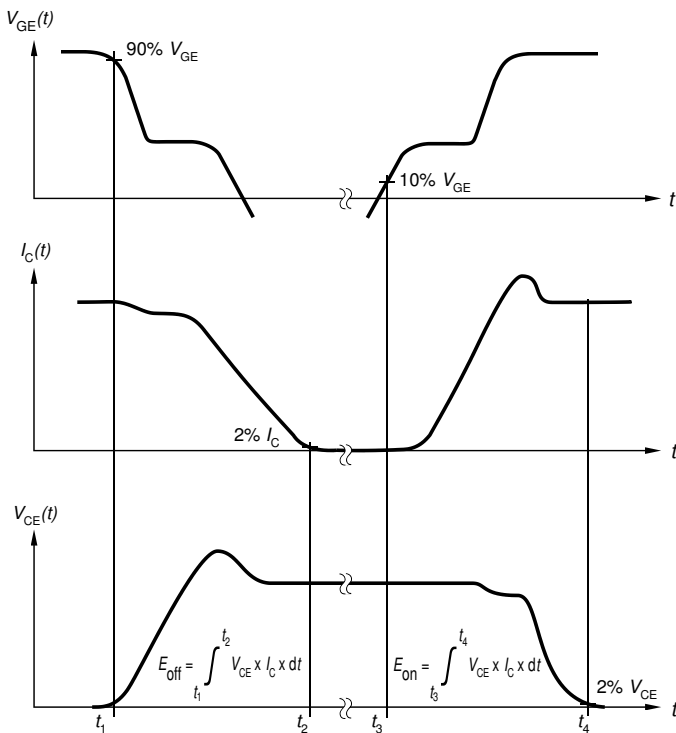


Figure B. Definition of switching losses

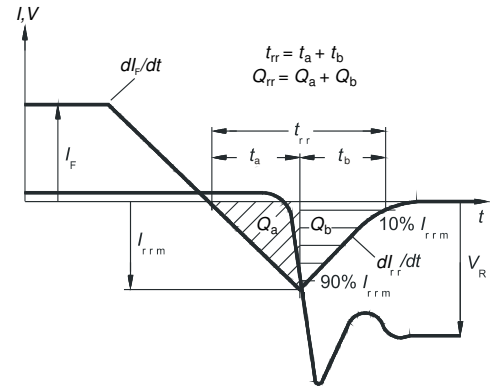


Figure C. Definition of diode switching characteristics

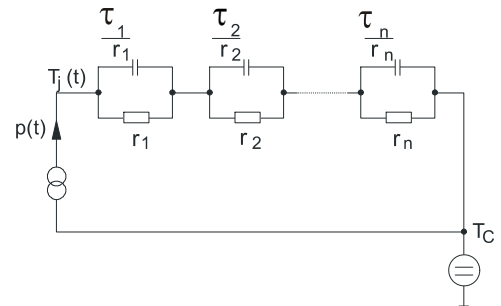


Figure D. Thermal equivalent circuit

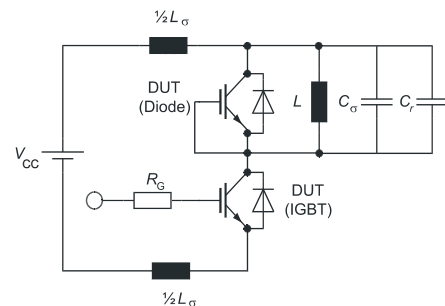


Figure E. **Dynamic test circuit**
Parasitic inductance L_{σ} ,
parasitic capacitor C_{σ} ,
relief capacitor C_r ,
(only for ZVT switching)

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Revision History

IGW30N65L5

Revision: 2020-10-07, Rev. 2.2

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

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