IGBT

High speed IGBT in Trench and Fieldstop technology

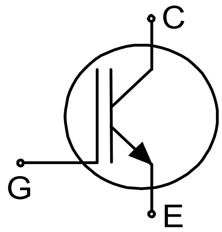
IGB20N60H3

600V high speed switching series third generation

Data sheet

Industrial Power Control

High speed IGBT in Trench and Fieldstop technology



Features:

TRENCHSTOP™ technology offering
- very low turn-off energy
- low V_{CEsat}
- low EMI
- maximum junction temperature 175°C
- qualified according to JEDEC for target applications
- Pb-free lead plating, halogen-free mould compound, RoHS compliant
- complete product spectrum and PSpice Models: http://www.infineon.com/igbt/

Applications:

- uninterruptible power supplies
- welding converters
- converters with high switching frequency

Green

Halogen-Free

RoHS

Key Performance and Package Parameters

Type	V_{CE}	I_C	V_{CEsat}, T_{vj}=25°C	T_{vjmax}	Marking	Package
IGB20N60H3	600V	20A	1.95V	175°C	G20H603	PG-TO263-3

Table of Contents

Maximum ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage, $T_{vj} \geq 25°C$	V_{CE}	600	V
DC collector current, limited by T_{vjmax} $T_C = 25°C$ $T_C = 100°C$	I_C	40.0 20.0	A
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpuls}	80.0	A
Turn off safe operating area $V_{CE} \leq 600V$, $T_{vj} \leq 175°C$, $t_p = 1µs$	-	80.0	A
Gate-emitter voltage	V_{GE}	±20	V
Short circuit withstand time $V_{GE} = 15.0V$, $V_{CC} \leq 400V$ Allowed number of short circuits < 1000 Time between short circuits: ≥ 1.0s $T_{vj} = 150°C$	t_{SC}	5	µs
Power dissipation $T_C = 25°C$ Power dissipation $T_C = 100°C$	P_{tot}	170.0 85.0	W
Operating junction temperature	T_{vj}	-40...+175	°C
Storage temperature	T_{stg}	-55...+150	°C
Soldering temperature, reflow soldering (MSL1 according to JEDEC J-STA-020)		260	°C

Thermal Resistance

Parameter	Symbol	Conditions	Max. Value	Unit
Characteristic				
IGBT thermal resistance, junction - case	$R_{th(j-c)}$		0.88	K/W
Thermal resistance, min. footprint junction - ambient	$R_{th(j-a)}$		65	K/W
Thermal resistance, 6cm² Cu on PCB junction - ambient	$R_{th(j-a)}$		40	K/W

Electrical Characteristic, at $T_{vj} = 25°C$, unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Static Characteristic						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0V$, $I_C = 2.00mA$	600	-	-	V
Collector-emitter saturation voltage	V_{CEsat}	$V_{GE} = 15.0V$, $I_C = 20.0A$ $T_{vj} = 25°C$ $T_{vj} = 125°C$ $T_{vj} = 175°C$	- - -	1.95 2.30 2.50	2.40 - -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C = 0.29mA$, $V_{CE} = V_{GE}$	4.1	5.1	5.7	V
Zero gate voltage collector current	I_{CES}	$V_{CE} = 600V$, $V_{GE} = 0V$ $T_{vj} = 25°C$ $T_{vj} = 175°C$	- -	- -	40.0 1500.0	µA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0V$, $V_{GE} = 20V$	-	-	100	nA
Transconductance	g_{fs}	$V_{CE} = 20V$, $I_C = 20.0A$	-	10.9	-	S

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

Parameter	Symbol	Conditions	Value min.	Value typ.	Value max.	Unit
Dynamic Characteristic						
Input capacitance	C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz	-	1100	-	pF
Output capacitance	C_{oes}		-	70	-	
Reverse transfer capacitance	C_{res}		-	32	-	
Gate charge	Q_G	V_{CC} = 480V, I_C = 20.0A, V_{GE} = 15V	-	120.0	-	nC
Short circuit collector current Max. 1000 short circuits Time between short circuits: ≥ 1.0s	$I_{C(SC)}$	V_{GE} = 15.0V, V_{CC} ≤ 400V, t_{SC} ≤ 5µs T_{vj} = 150°C	-	120	-	A

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value min.	Value typ.	Value max.	Unit
IGBT Characteristic, at T_{vj} = 25°C						
Turn-on delay time	$t_{d(on)}$	T_{vj} = 25°C, V_{CC} = 400V, I_C = 20.0A, V_{GE} = 0.0/15.0V, r_G = 14.6Ω, $L\sigma$ = 75nH, $C\sigma$ = 30pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include "tail" and diode (IKP20N60H3) reverse recovery.	-	16	-	ns
Rise time	t_r		-	20	-	ns
Turn-off delay time	$t_{d(off)}$		-	194	-	ns
Fall time	t_f		-	11	-	ns
Turn-on energy	E_{on}		-	0.45	-	mJ
Turn-off energy	E_{off}		-	0.24	-	mJ
Total switching energy	E_{ts}		-	0.69	-	mJ

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value min.	Value typ.	Value max.	Unit
IGBT Characteristic, at T_{vj} = 175°C						
Turn-on delay time	$t_{d(on)}$	T_{vj} = 175°C, V_{CC} = 400V, I_C = 20.0A, V_{GE} = 0.0/15.0V, r_G = 14.6Ω, $L\sigma$ = 75nH, $C\sigma$ = 30pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include "tail" and diode (IKP20N60H3) reverse recovery.	-	16	-	ns
Rise time	t_r		-	15	-	ns
Turn-off delay time	$t_{d(off)}$		-	227	-	ns
Fall time	t_f		-	14	-	ns
Turn-on energy	E_{on}		-	0.60	-	mJ
Turn-off energy	E_{off}		-	0.36	-	mJ
Total switching energy	E_{ts}		-	0.96	-	mJ

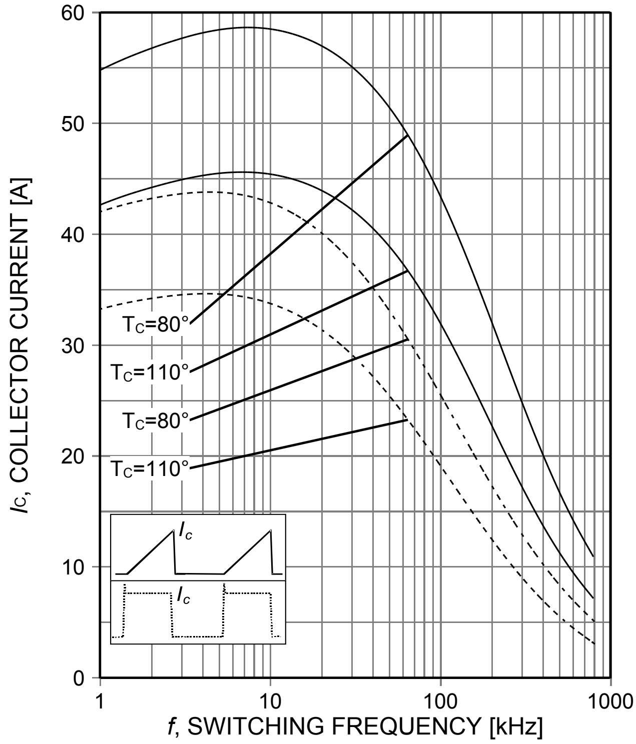


Figure 1. **Collector current as a function of switching frequency**
(T_j≤175°C, D=0.5, V_{CE}=400V, V_{GE}=15/0V, r_G=14,6Ω)

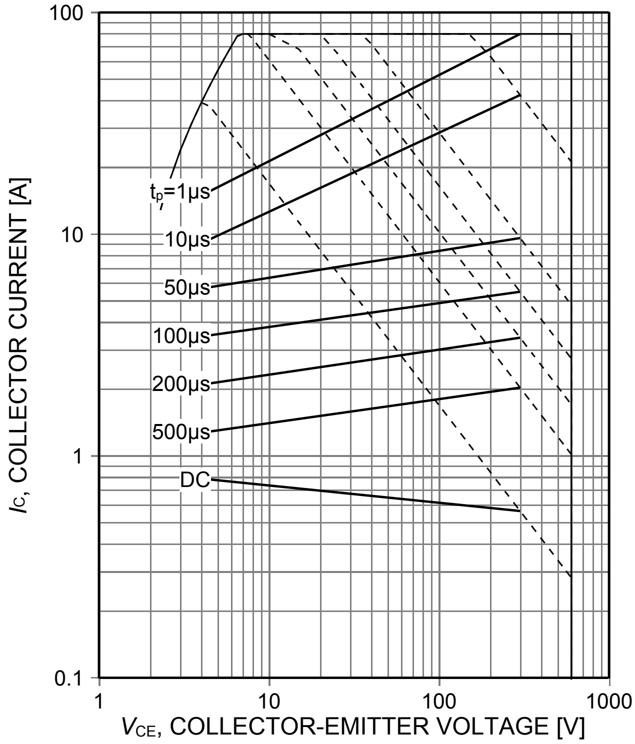


Figure 2. **Forward bias safe operating area**
(D=0, T_C=25°C, T_j≤175°C; V_{GE}=15V)

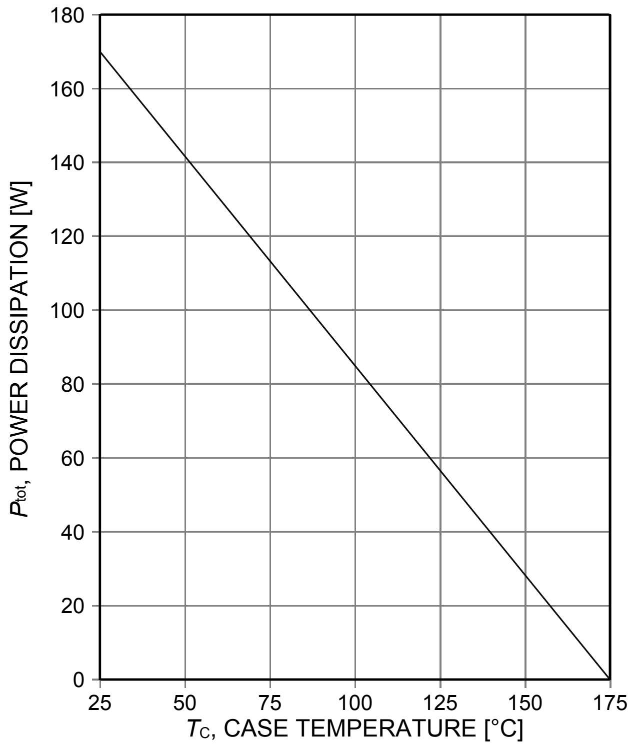


Figure 3. **Power dissipation as a function of case temperature**
(T_j≤175°C)

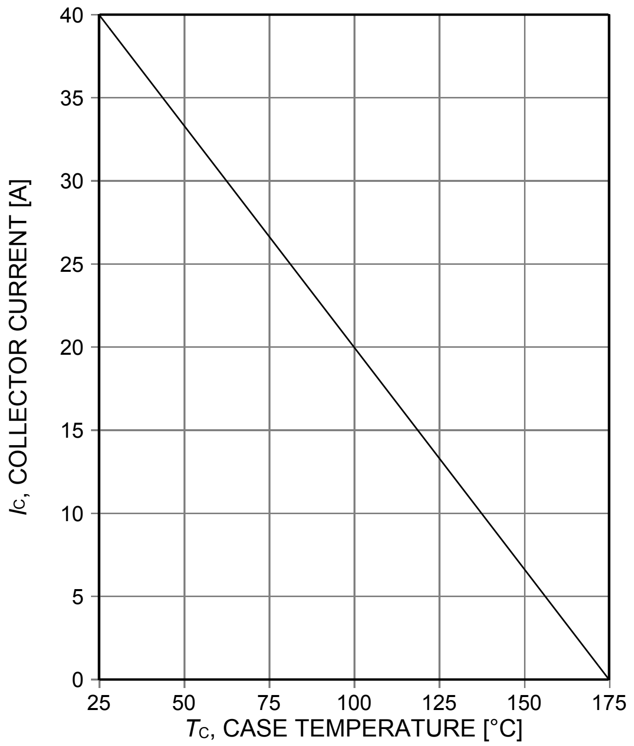


Figure 4. **Collector current as a function of case temperature**
(V_{GE}≥15V, T_j≤175°C)

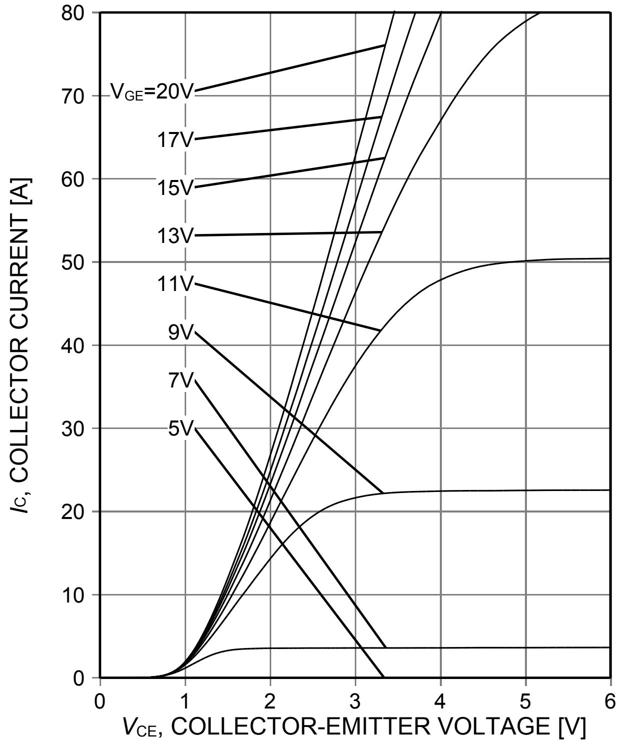


Figure 5. **Typical output characteristic**
(T_j=25°C)

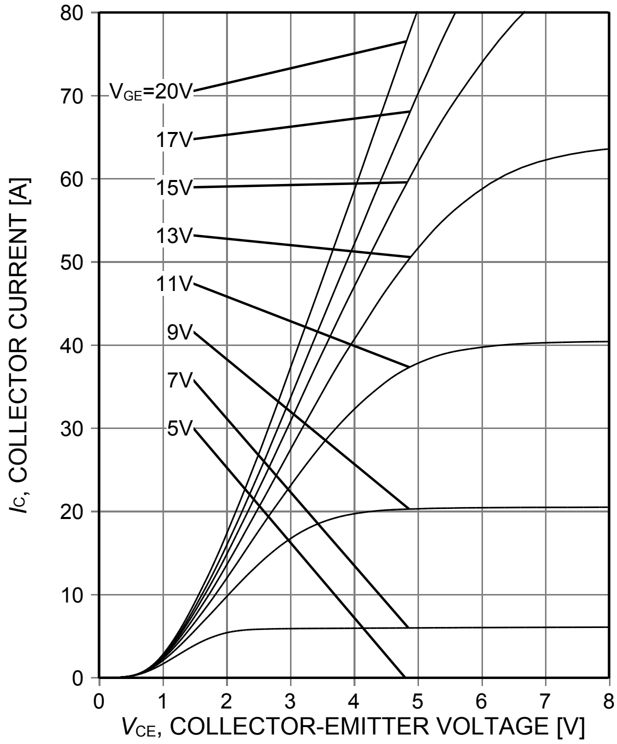


Figure 6. **Typical output characteristic**
(T_j=175°C)

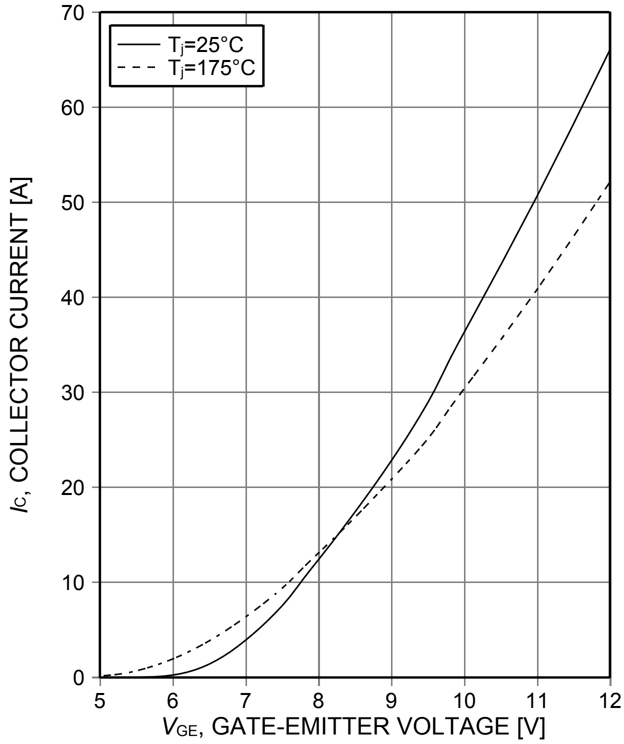


Figure 7. **Typical transfer characteristic**
(V_{CE}=20V)

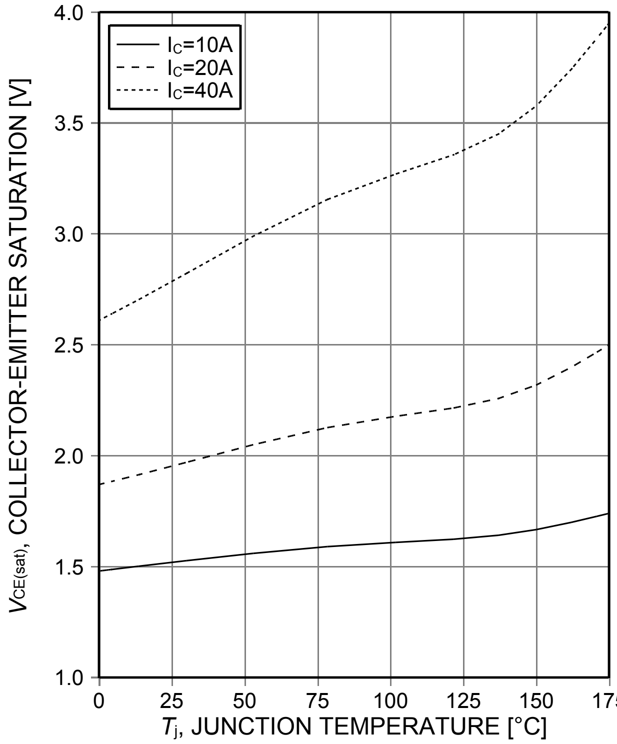


Figure 8. **Typical collector-emitter saturation voltage as a function of junction temperature**
(V_{GE}=15V)

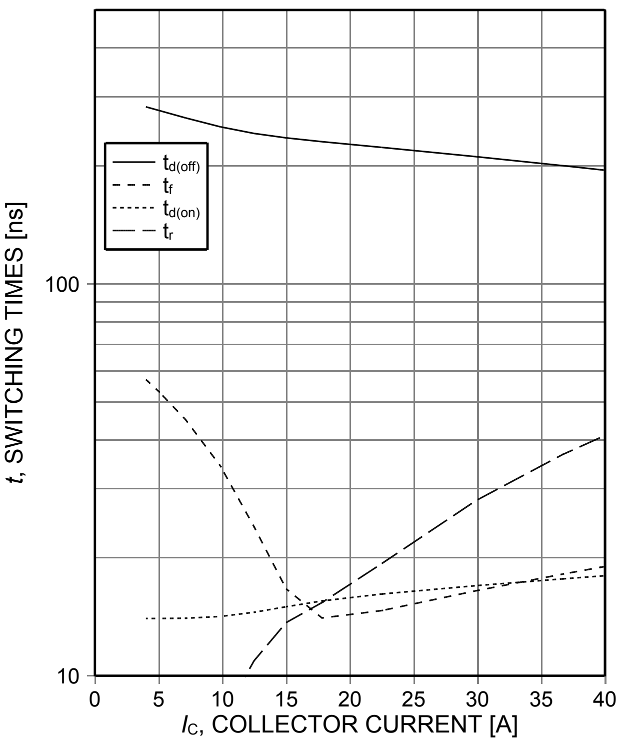


Figure 9. **Typical switching times as a function of collector current**
(ind. load, T_j=175°C, V_{CE}=400V, V_{GE}=15/0V, r_G=14,6Ω, test circuit in Fig. E)

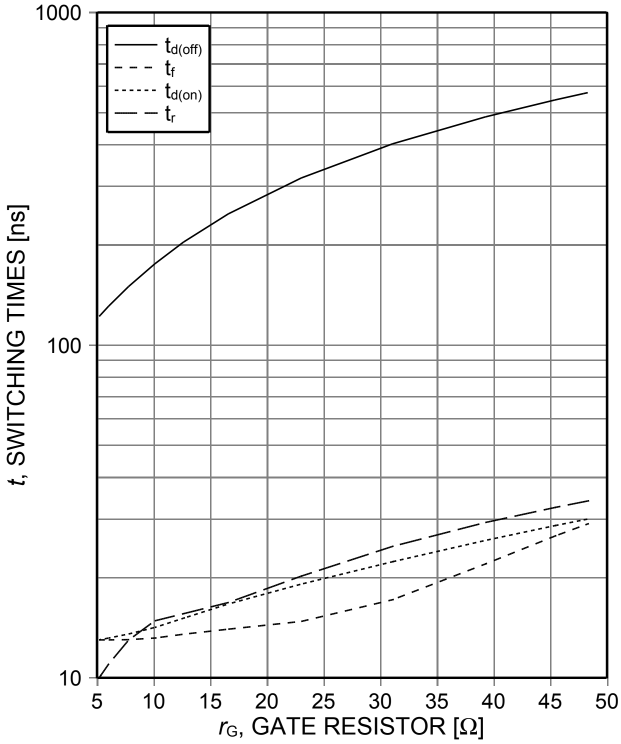


Figure 10. **Typical switching times as a function of gate resistor**
(ind. load, T_j=175°C, V_{CE}=400V, V_{GE}=15/0V, I_C=20A, test circuit in Fig. E)

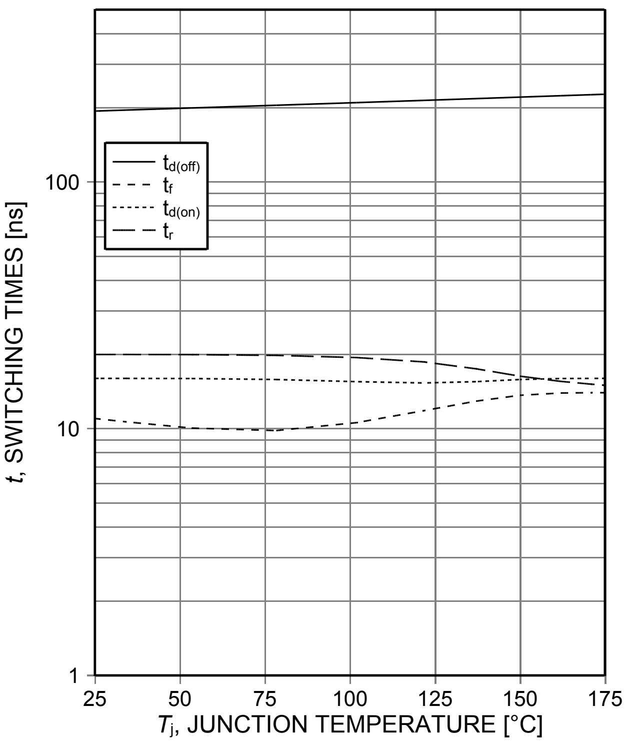


Figure 11. **Typical switching times as a function of junction temperature**
(ind. load, V_{CE}=400V, V_{GE}=15/0V, I_C=20A, r_G=14,6Ω, test circuit in Fig. E)

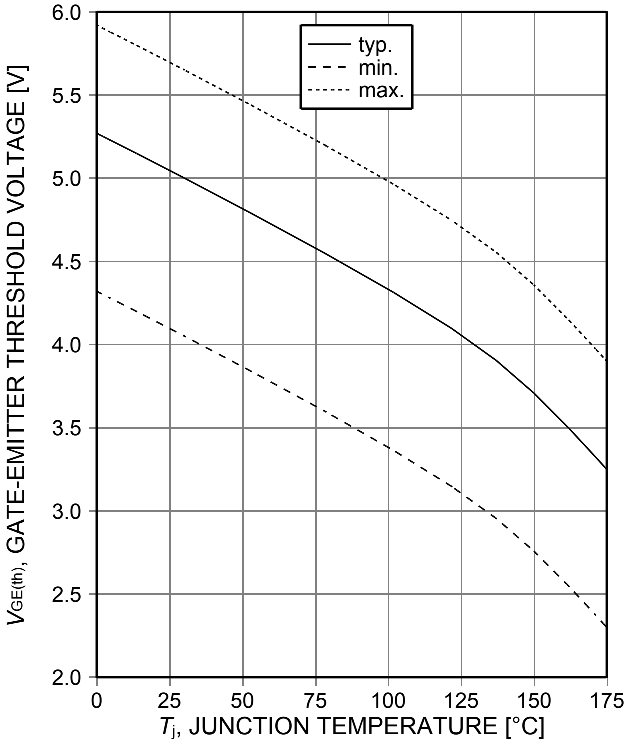


Figure 12. **Gate-emitter threshold voltage as a function of junction temperature**
(I_C=0.29mA)

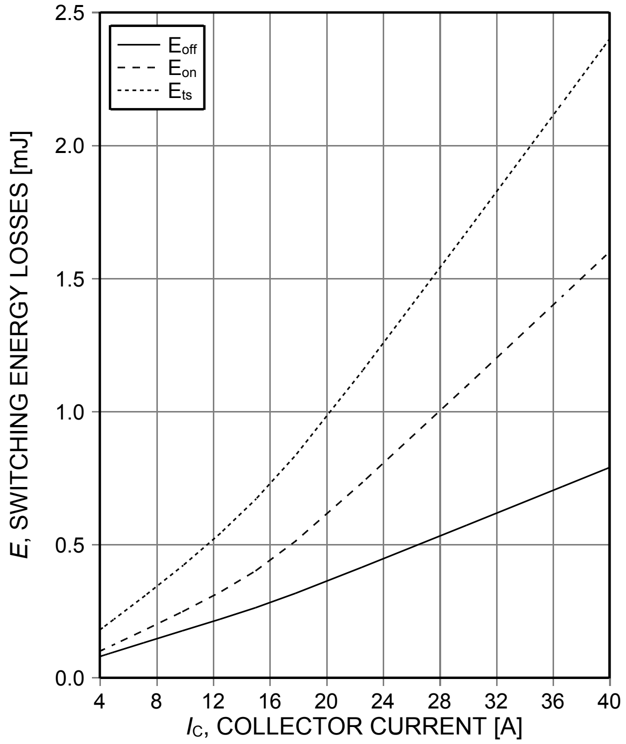


Figure 13. **Typical switching energy losses as a function of collector current**
(ind. load, T_j=175°C, V_{CE}=400V, V_{GE}=15/0V, r_G=14,6Ω, test circuit in Fig. E)

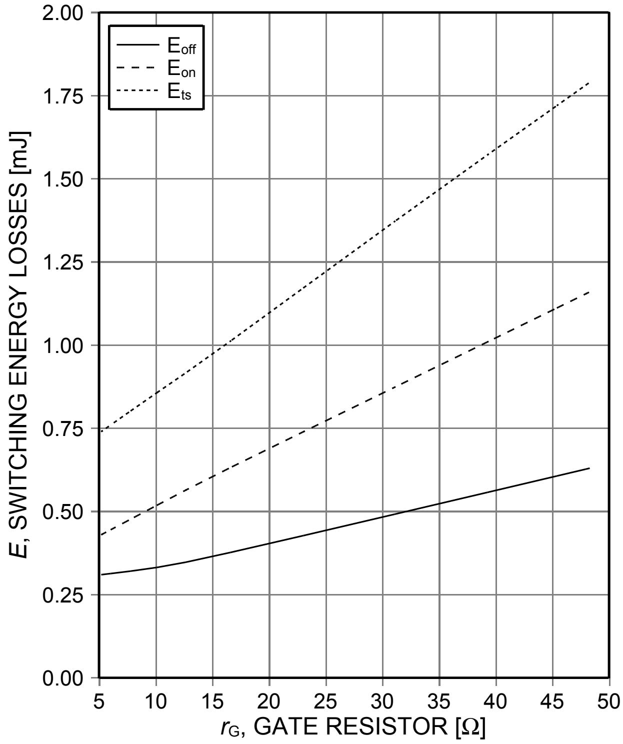


Figure 14. **Typical switching energy losses as a function of gate resistor**
(ind. load, T_j=175°C, V_{CE}=400V, V_{GE}=15/0V, I_C=20A, test circuit in Fig. E)

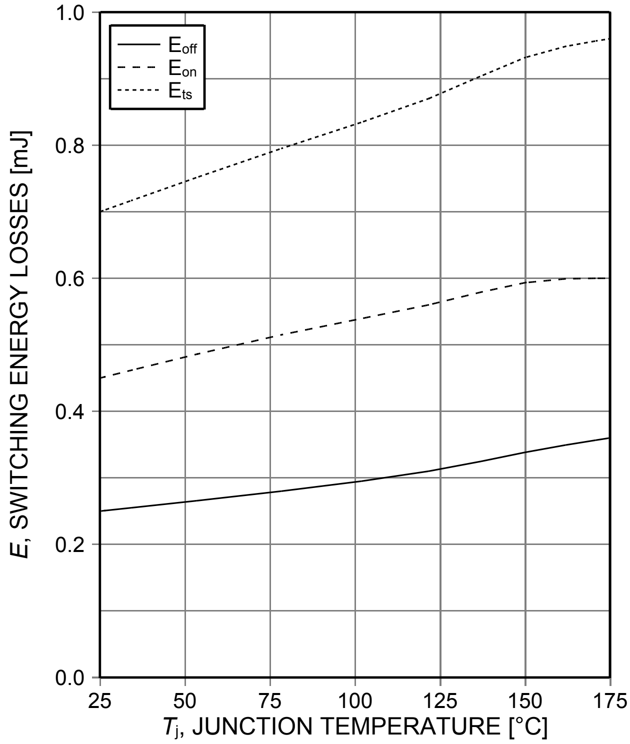


Figure 15. **Typical switching energy losses as a function of junction temperature**
(ind load, V_{CE}=400V, V_{GE}=15/0V, I_C=20A, r_G=14,6Ω, test circuit in Fig. E)

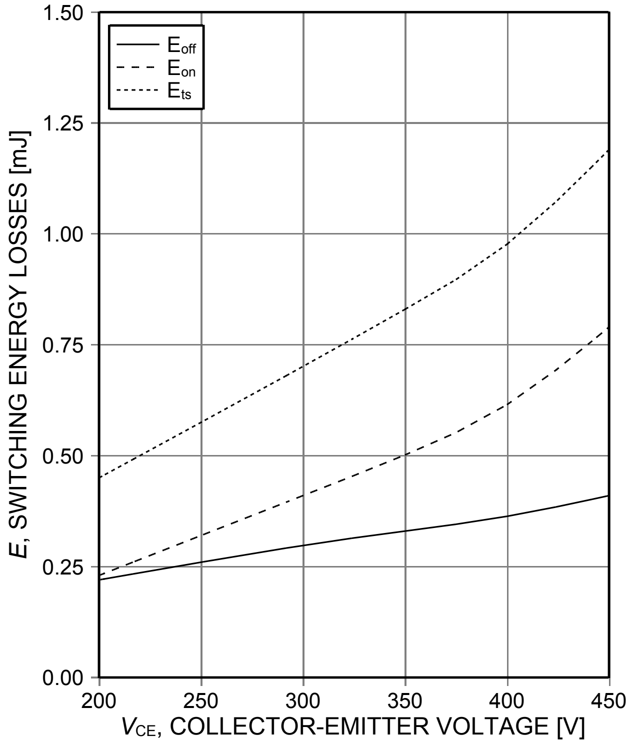


Figure 16. **Typical switching energy losses as a function of collector emitter voltage**
(ind. load, T_j=175°C, V_{GE}=15/0V, I_C=20A, r_G=14,6Ω, test circuit in Fig. E)

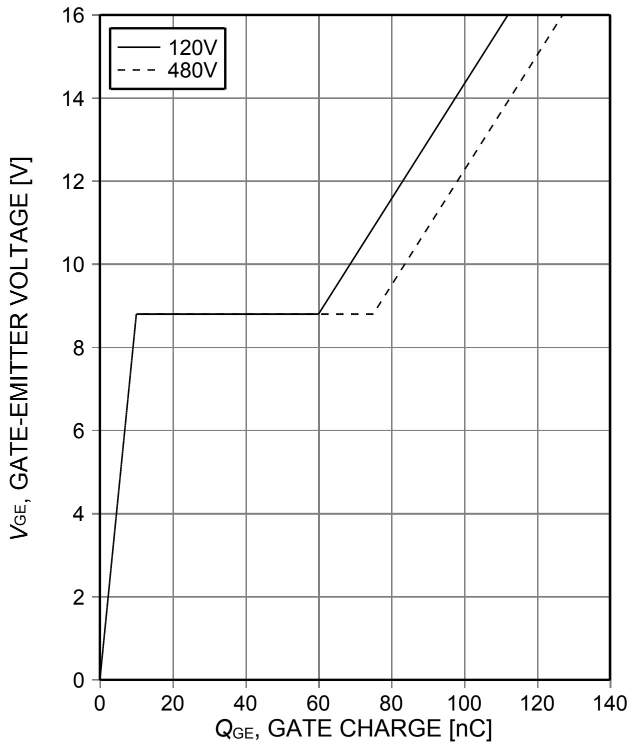


Figure 17. **Typical gate charge**
(I_C=20A)

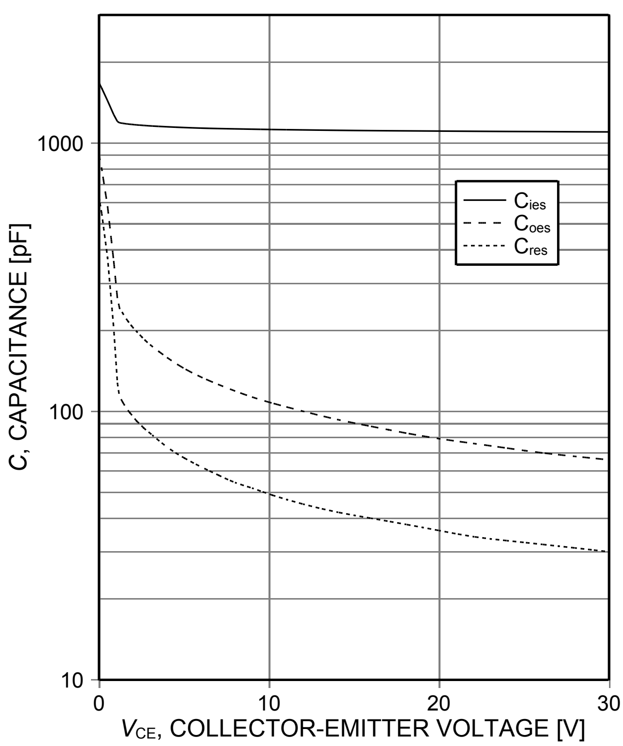


Figure 18. **Typical capacitance as a function of collector-emitter voltage**
(V_{GE}=0V, f=1MHz)

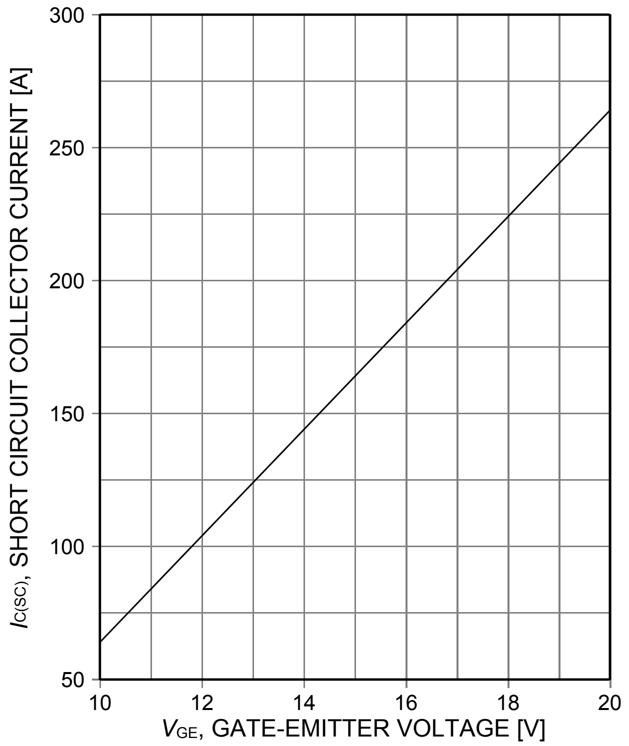


Figure 19. **Typical short circuit collector current as a function of gate-emitter voltage**
(V_{CE}≤400V, start at T_j=25°C)

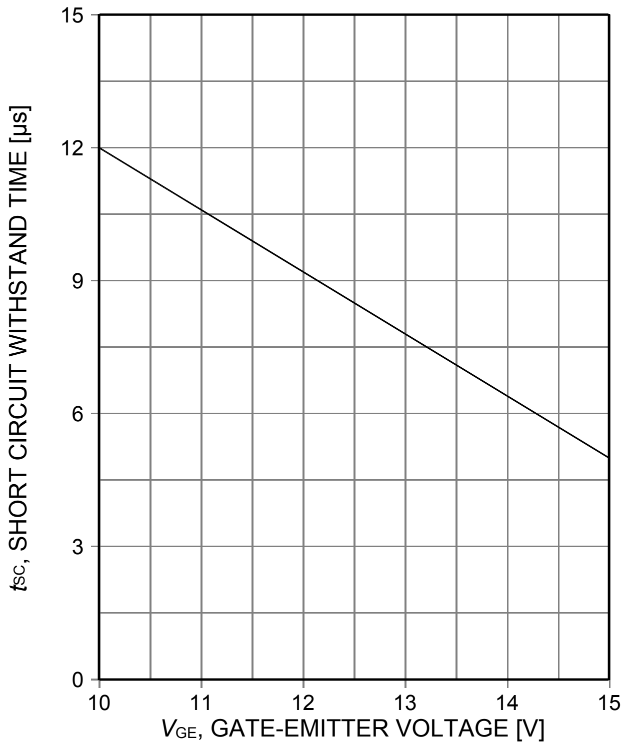


Figure 20. **Short circuit withstand time as a function of gate-emitter voltage**
(V_{CE}≤400V, start at T_j≤150°C)

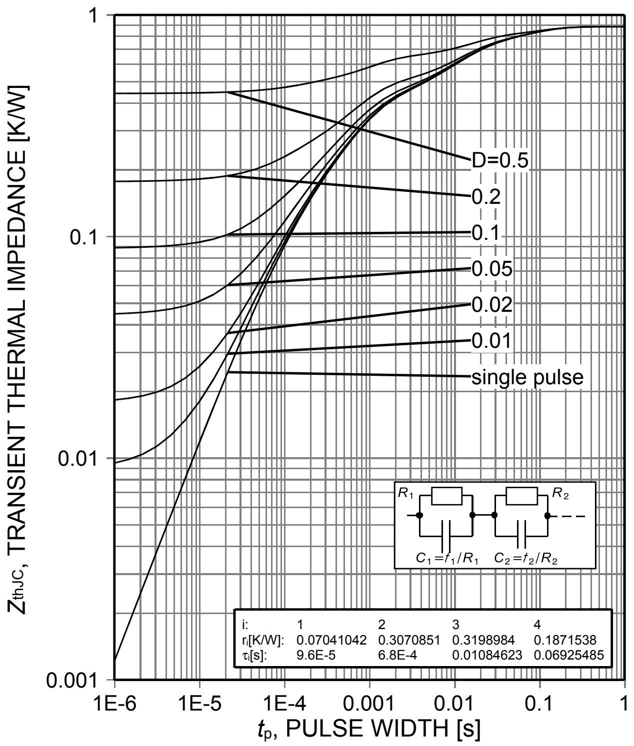
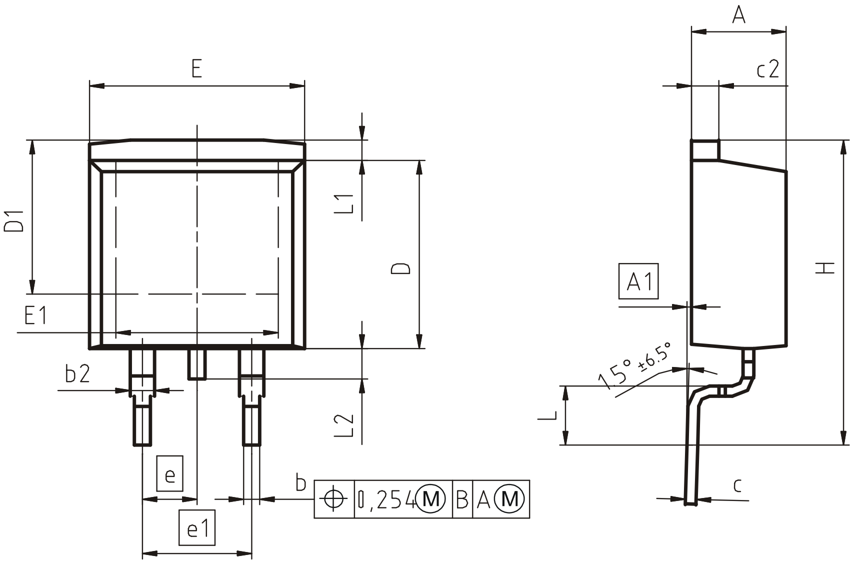
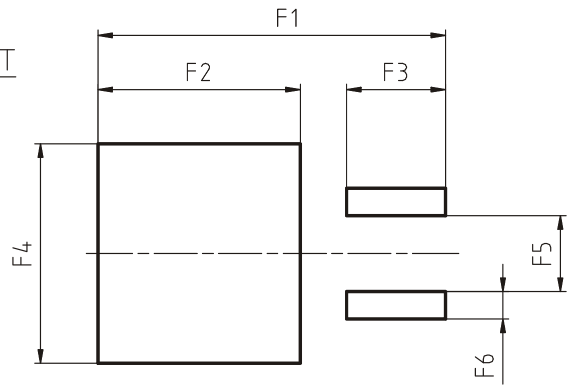


Figure 21. **IGBT transient thermal impedance**
(D=t_p/T)

PG-TO263-3



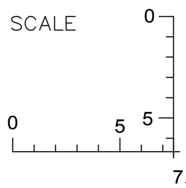
FOOTPRINT



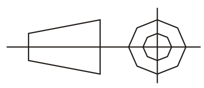
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.57	0.169	0.180
A1	0.00	0.25	0.000	0.010
b	0.65	0.85	0.026	0.033
b2	0.95	1.15	0.037	0.045
c	0.33	0.65	0.013	0.026
c2	1.17	1.40	0.046	0.055
D	8.51	9.45	0.335	0.372
D1	7.10	7.90	0.280	0.311
E	9.80	10.31	0.386	0.406
E1	6.50	8.60	0.256	0.339
e	2.54		0.100	
e1	5.08		0.200	
N	2		2	
H	14.61	15.88	0.575	0.625
L	2.29	3.00	0.090	0.118
L1	0.70	1.60	0.028	0.063
L2	1.00	1.78	0.039	0.070
F1	16.05	16.25	0.632	0.640
F2	9.30	9.50	0.366	0.374
F3	4.50	4.70	0.177	0.185
F4	10.70	10.90	0.421	0.429
F5	3.65	3.85	0.144	0.152
F6	1.25	1.45	0.049	0.057

DOCUMENT NO.
Z8B00003324

SCALE



EUROPEAN PROJECTION



ISSUE DATE
30-08-2007

REVISION
01

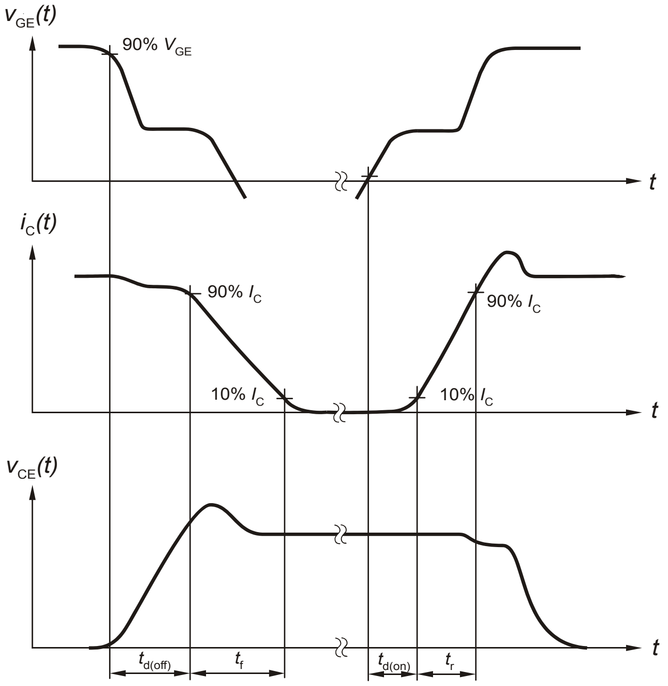


Figure A. Definition of switching times

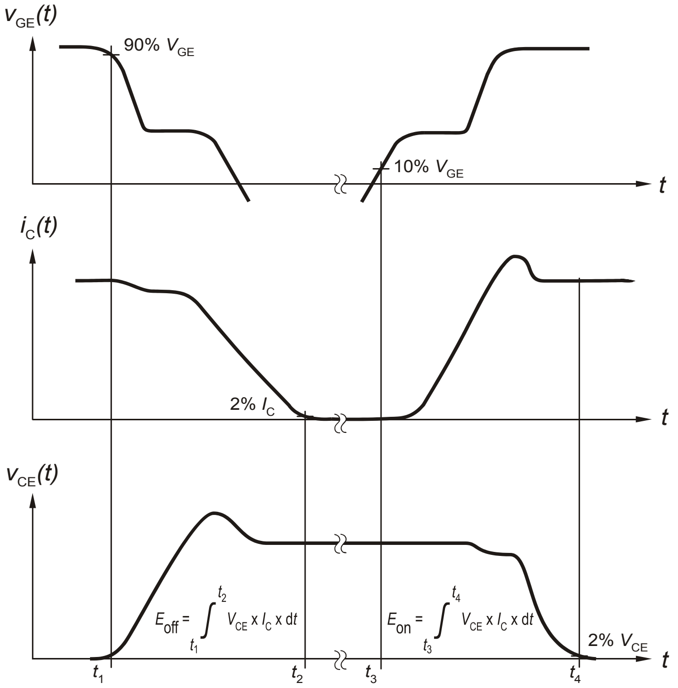


Figure B. Definition of switching losses

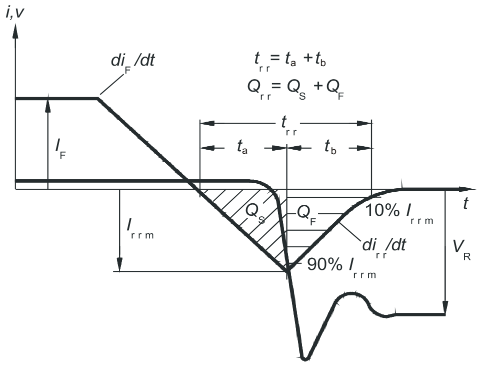


Figure C. Definition of diodes switching characteristics

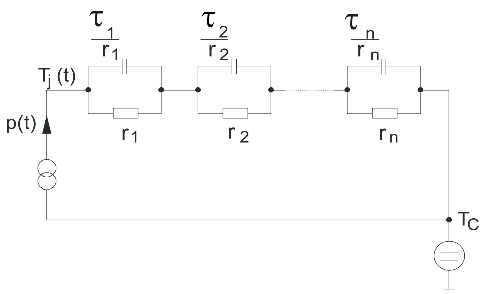


Figure D. Thermal equivalent circuit

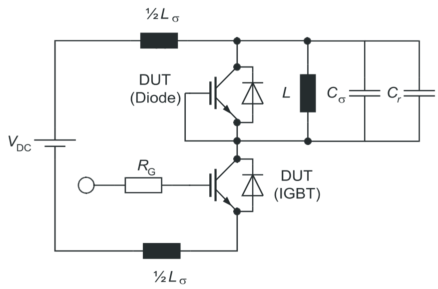


Figure E. Dynamic test circuit

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

Revision History

IGB20N60H3

Revision: 2014-03-11, Rev. 2.3

Previous Revision

Revision	Date	Subjects (major changes since last revision)
1.1	2010-07-26	Preliminary datasheet
2.1	2013-12-09	New value IRmax limit at 175°C
2.2	2014-02-26	Without PB free logo
2.3	2014-03-11	Max ratings Vce, Tvj ≥ 25°C

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