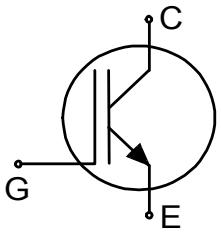
High speed switching series fifth generation

# High speed IGBT in TRENCHSTOP™ 5 technology

**Features and Benefits:**




High speed H5 technology offering:
- Best-in-Class efficiency in hard switching and resonant topologies
- Plug and play replacement of previous generation IGBTs
- 650V breakdown voltage
- Low gate charge $Q_G$
- Maximum junction temperature 175°C
- Dynamically stress tested
- Qualified according to AEC-Q101
- Green package (RoHS compliant)
- Complete product spectrum and PSpice Models: http://www.infineon.com/igbt/


**Applications:**

- Off-board charger
- On-board charger
- DC/DC converter
- Power-Factor correction

**Package pin definition:**

- Pin 1 - gate
- Pin 2 & backside - collector
- Pin 3 - emitter

**Key Performance and Package Parameters**

| Type | $V_{CE}$ | $I_C$ | $V_{CEsat}$, $T_{vj}$=25°C | $T_{vjmax}$ | Marking | Package |
|---|---|---|---|---|---|---|
| AIGB30N65H5 | 650V | 30A | 1.65V | 175°C | AG30EH5 | PG-TO263-3 |

**Table of Contents**

### Maximum Ratings

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Collector-emitter voltage, $T_{vj} \geq 25°C$ | $V_{CE}$ | 650 | V |
| DC collector current, limited by $T_{vjmax}$<br>$T_c = 25°C$<br>$T_c = 100°C$ | $I_C$ | <br>55.0<br>35.0 | A |
| Pulsed collector current, $t_p$ limited by $T_{vjmax}$ [1)] | $I_{Cpuls}$ | 90.0 | A |
| Turn off safe operating area<br>$V_{CE} \leq 650V$, $T_{vj} \leq 175°C$, $t_p = 1\mu s$ [1)] | - | 90.0 | A |
| Gate-emitter voltage<br>Transient Gate-emitter voltage ($t_p \leq 10\mu s$, $D < 0.010$) | $V_{GE}$ | ±20<br>±30 | V |
| Power dissipation $T_c = 25°C$<br>Power dissipation $T_c = 100°C$ | $P_{tot}$ | 188.0<br>93.0 | W |
| Operating junction temperature | $T_{vj}$ | -40...+175 | °C |
| Storage temperature | $T_{stg}$ | -55...+150 | °C |
| Soldering temperature,<br>reflow soldering (MSL1 according to JEDEC J-STA-020) | | 260 | °C |

### Thermal Resistance

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **$R_{th}$ Characteristics** | | | | | | |
| IGBT thermal resistance,<br>junction - case | $R_{th(j-c)}$ | | - | - | 0.80 | K/W |
| Thermal resistance, min. footprint<br>junction - ambient | $R_{th(j-a)}$ | | - | - | 65 | K/W |
| Thermal resistance, 6cm² Cu on PCB<br>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 | $V_{(BR)CES}$ | $V_{GE} = 0V$, $I_C = 0.20mA$ | 650 | - | - | V |
| Collector-emitter saturation voltage | $V_{CEsat}$ | $V_{GE} = 15.0V$, $I_C = 30.0A$<br>$T_{vj} = 25°C$<br>$T_{vj} = 125°C$<br>$T_{vj} = 175°C$ | <br>-<br>-<br>- | <br>1.65<br>1.85<br>1.95 | <br>2.10<br>-<br>- | V |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | $I_C = 0.30mA$, $V_{CE} = V_{GE}$ | 3.2 | 4.0 | 4.8 | V |
| Zero gate voltage collector current | $I_{CES}$ | $V_{CE} = 650V$, $V_{GE} = 0V$<br>$T_{vj} = 25°C$<br>$T_{vj} = 175°C$ | <br>-<br>- | <br>-<br>1000 | <br>40<br>- | µA |
| Gate-emitter leakage current | $I_{GES}$ | $V_{CE} = 0V$, $V_{GE} = 20V$ | - | - | 100 | nA |
| Transconductance | $g_{fs}$ | $V_{CE} = 20V$, $I_C = 30.0A$ | - | 30.0 | - | S |

[1)] Defined by design. Not subject to production test.

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

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Dynamic Characteristic** | | | | | | |
| Input capacitance | $C_{ies}$ | $V_{CE}$ = 25V, $V_{GE}$ = 0V, f = 1MHz | - | 1800 | - | pF |
| Output capacitance | $C_{oes}$ | | - | 50 | - | |
| Reverse transfer capacitance | $C_{res}$ | | - | 10 | - | |
| Gate charge | $Q_G$ | $V_{CC}$ = 520V, $I_C$ = 30.0A, $V_{GE}$ = 15V | - | 70.0 | - | nC |
| Internal emitter inductance measured 5mm (0.197 in.) from case | $L_E$ | | - | 7.0 | - | nH |

**Switching Characteristic, Inductive Load**

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **IGBT Characteristic, at $T_{vj}$ = 25°C** | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $T_{vj}$ = 25°C, $V_{CC}$ = 400V, $I_C$ = 15.0A, $V_{GE}$ = 0.0/15.0V, $R_{G(on)}$ = 23.0Ω, $R_{G(off)}$ = 23.0Ω, Lσ = 30nH, Cσ = 30pF Lσ, Cσ from Fig. E Energy losses include “tail” and diode reverse recovery. | - | 24 | - | ns |
| Rise time | $t_r$ | | - | 15 | - | ns |
| Turn-off delay time | $t_{d(off)}$ | | - | 184 | - | ns |
| Fall time | $t_f$ | | - | 24 | - | ns |
| Turn-on energy | $E_{on}$ | | - | 0.32 | - | mJ |
| Turn-off energy | $E_{off}$ | | - | 0.09 | - | mJ |
| Total switching energy | $E_{ts}$ | | - | 0.41 | - | mJ |
| Turn-on delay time | $t_{d(on)}$ | $T_{vj}$ = 25°C, $V_{CC}$ = 400V, $I_C$ = 5.0A, $V_{GE}$ = 0.0/15.0V, $R_{G(on)}$ = 23.0Ω, $R_{G(off)}$ = 23.0Ω, Lσ = 30nH, Cσ = 30pF Lσ, Cσ from Fig. E Energy losses include “tail” and diode reverse recovery. | - | 22 | - | ns |
| Rise time | $t_r$ | | - | 8 | - | ns |
| Turn-off delay time | $t_{d(off)}$ | | - | 188 | - | ns |
| Fall time | $t_f$ | | - | 27 | - | ns |
| Turn-on energy | $E_{on}$ | | - | 0.11 | - | mJ |
| Turn-off energy | $E_{off}$ | | - | 0.03 | - | mJ |
| Total switching energy | $E_{ts}$ | | - | 0.14 | - | mJ |

**Switching Characteristic, Inductive Load**

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **IGBT Characteristic, at $T_{vj}$ = 150°C** | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $T_{vj}$ = 150°C, $V_{CC}$ = 400V, $I_C$ = 15.0A, $V_{GE}$ = 0.0/15.0V, $R_{G(on)}$ = 23.0Ω, $R_{G(off)}$ = 23.0Ω, Lσ = 30nH, Cσ = 30pF Lσ, Cσ from Fig. E Energy losses include “tail” and diode reverse recovery. | - | 23 | - | ns |
| Rise time | $t_r$ | | - | 15 | - | ns |
| Turn-off delay time | $t_{d(off)}$ | | - | 203 | - | ns |
| Fall time | $t_f$ | | - | 19 | - | ns |
| Turn-on energy | $E_{on}$ | | - | 0.44 | - | mJ |
| Turn-off energy | $E_{off}$ | | - | 0.11 | - | mJ |
| Total switching energy | $E_{ts}$ | | - | 0.55 | - | mJ |
| Turn-on delay time | $t_{d(on)}$ | $T_{vj}$ = 150°C, $V_{CC}$ = 400V, $I_C$ = 5.0A, $V_{GE}$ = 0.0/15.0V, $R_{G(on)}$ = 23.0Ω, $R_{G(off)}$ = 23.0Ω, Lσ = 30nH, Cσ = 30pF Lσ, Cσ from Fig. E Energy losses include “tail” and diode reverse recovery. | - | 20 | - | ns |
| Rise time | $t_r$ | | - | 9 | - | ns |
| Turn-off delay time | $t_{d(off)}$ | | - | 215 | - | ns |
| Fall time | $t_f$ | | - | 30 | - | ns |
| Turn-on energy | $E_{on}$ | | - | 0.16 | - | mJ |
| Turn-off energy | $E_{off}$ | | - | 0.04 | - | mJ |
| Total switching energy | $E_{ts}$ | | - | 0.20 | - | mJ |

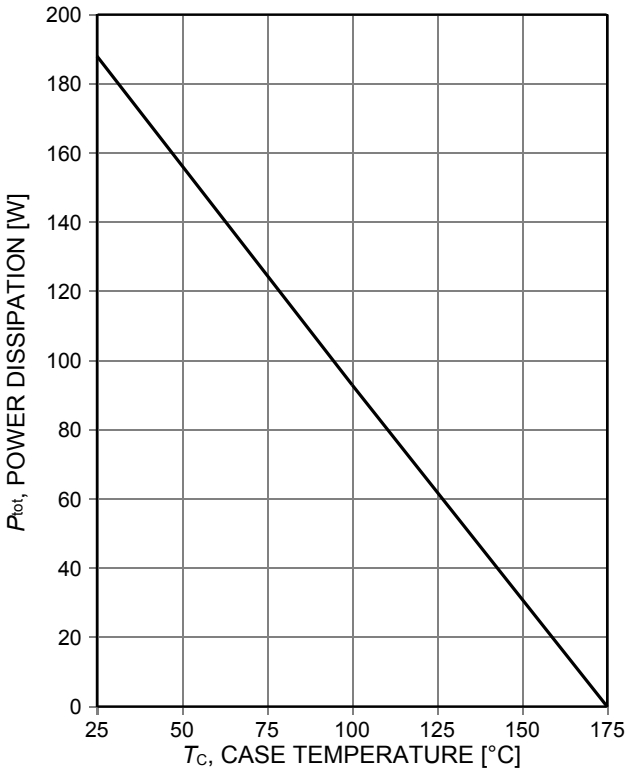



Figure 1. **Power dissipation as a function of case temperature**
($T_{vj}$≤175°C)

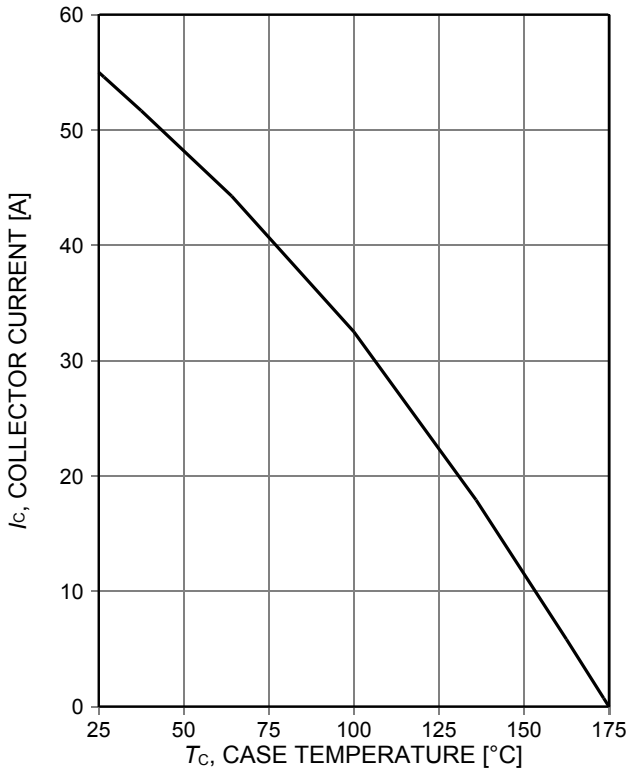



Figure 2. **Collector current as a function of case temperature**
($V_{GE}$≥15V, $T_{vj}$≤175°C)

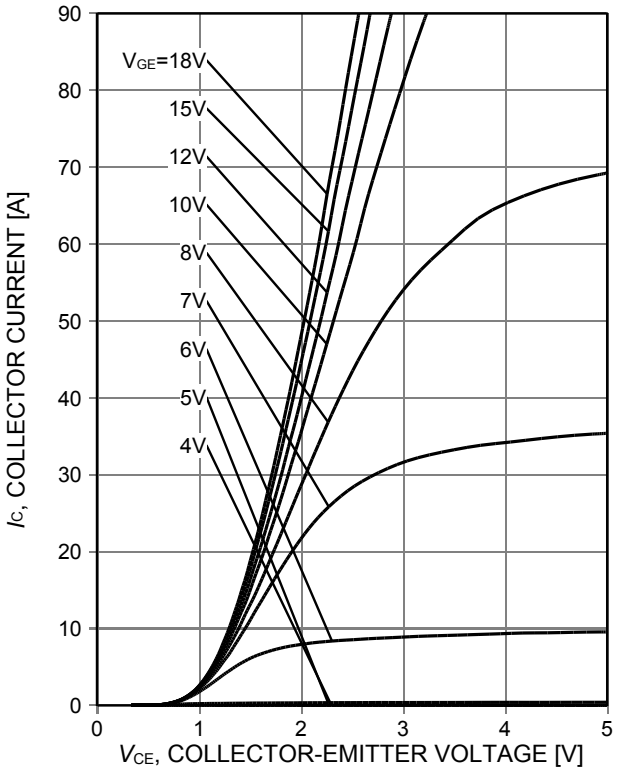



Figure 3. **Typical output characteristic**
($T_{vj}$=25°C)

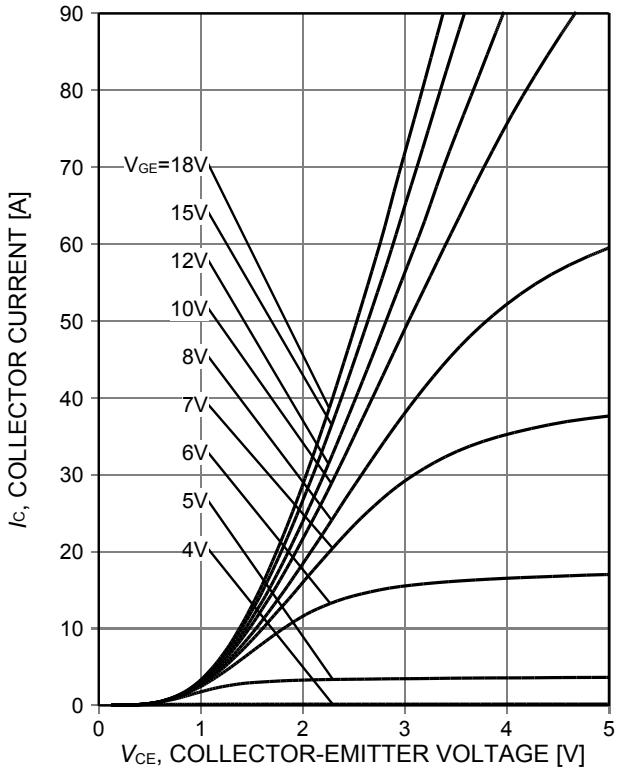



Figure 4. **Typical output characteristic**
($T_{vj}$=150°C)

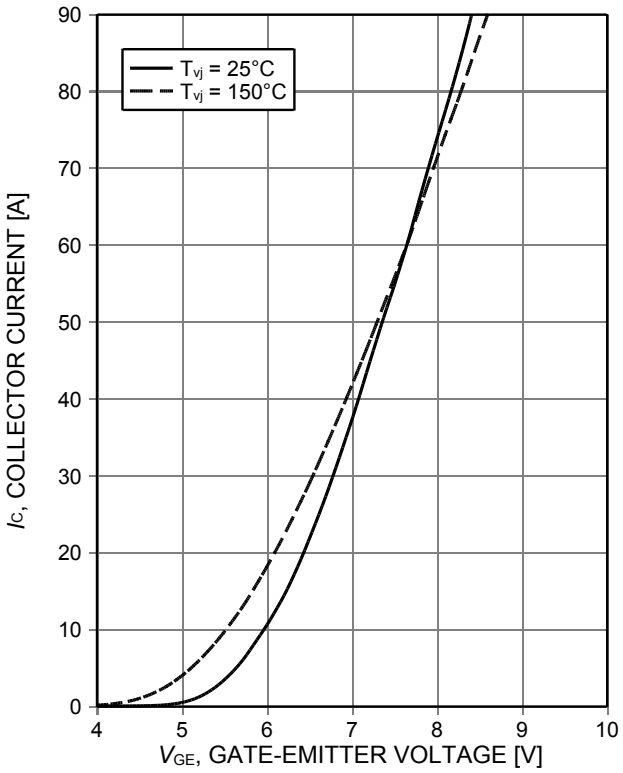



Figure 5. **Typical transfer characteristic** ($V_{CE}$=20V)

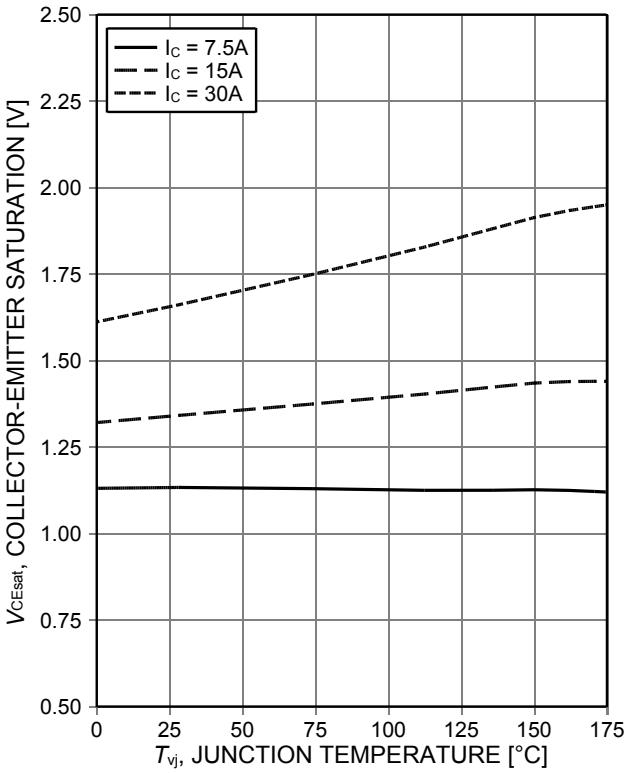



Figure 6. **Typical collector-emitter saturation voltage as a function of junction temperature** ($V_{GE}$=15V)

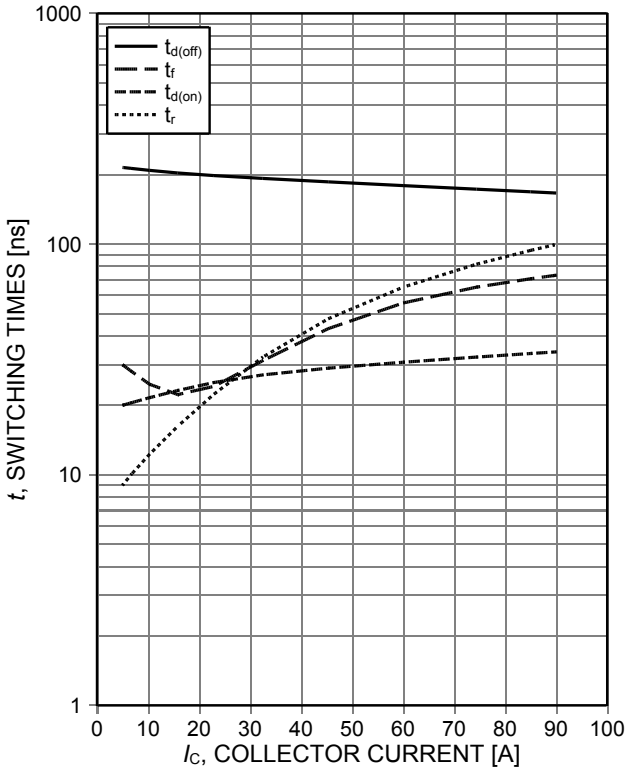



Figure 7. **Typical switching times as a function of collector current** (inductive load, $T_{vj}$=150°C, $V_{CE}$=400V, $V_{GE}$=15/0V, $r_G$=23Ω, Dynamic test circuit in Figure E)

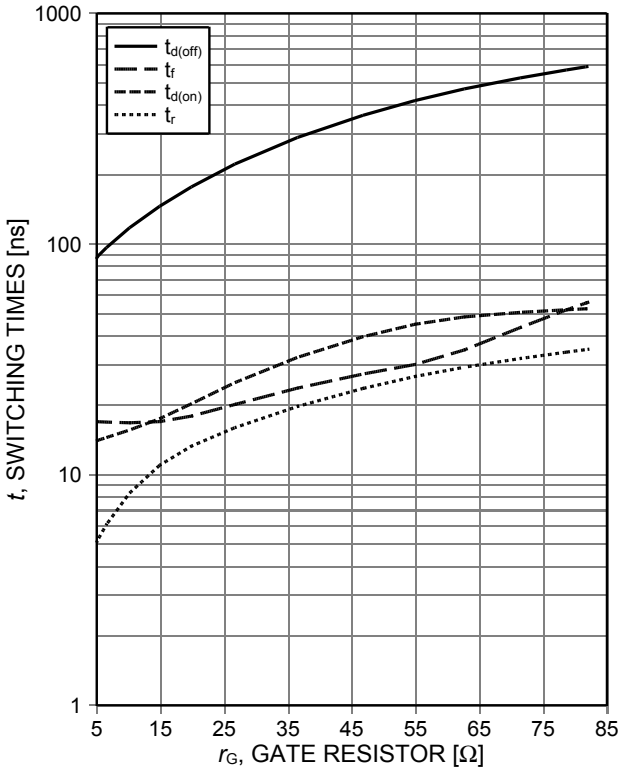



Figure 8. **Typical switching times as a function of gate resistor** (inductive load, $T_{vj}$=150°C, $V_{CE}$=400V, $V_{GE}$=15/0V, $I_C$=15A,Dynamic test circuit in Figure E)

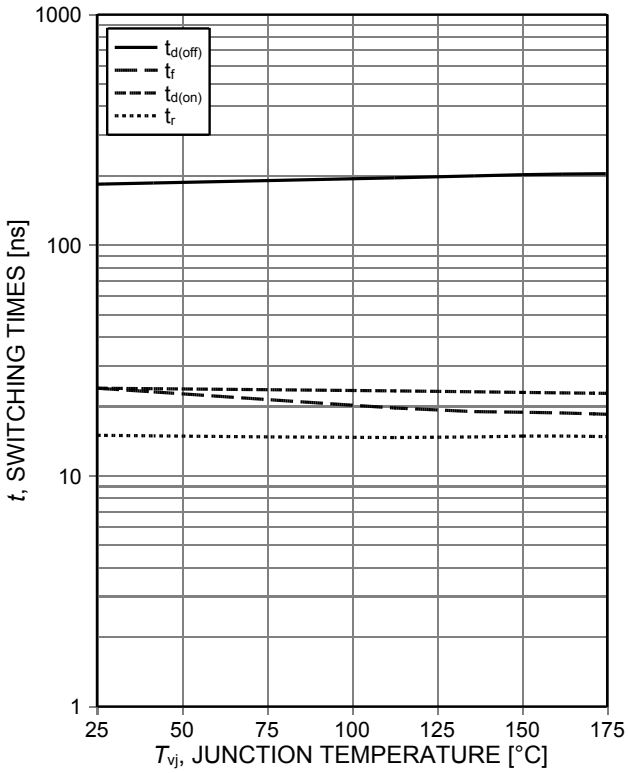



Figure 9. **Typical switching times as a function of junction temperature**
(inductive load, $V_{CE}$=400V, $V_{GE}$=15/0V, $I_C$=15A, $r_G$=23Ω,Dynamic test circuit in Figure E)

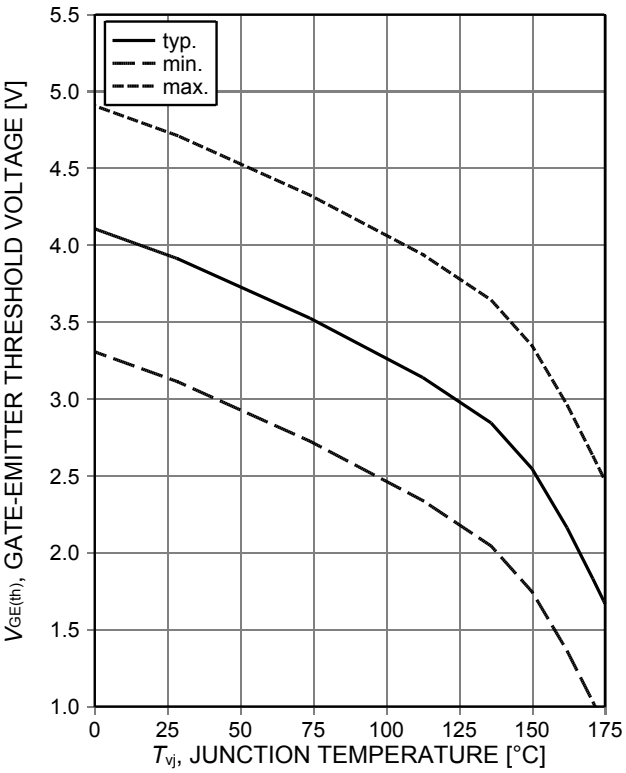



Figure 10. **Gate-emitter threshold voltage as a function of junction temperature**
($I_C$=0.3mA)

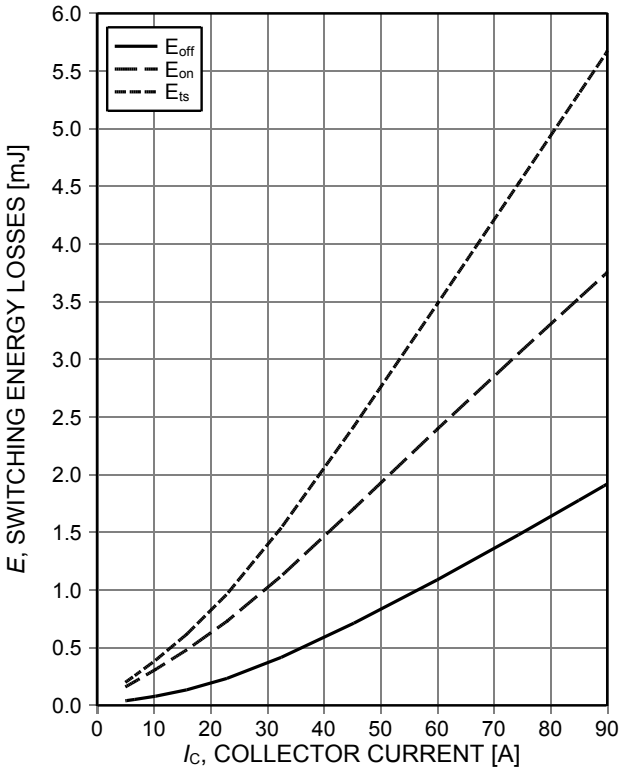



Figure 11. **Typical switching energy losses as a function of collector current**
(inductive load, $T_{vj}$=150°C, $V_{CE}$=400V, $V_{GE}$=15/0V, $r_G$=23Ω,Dynamic test circuit in Figure E)

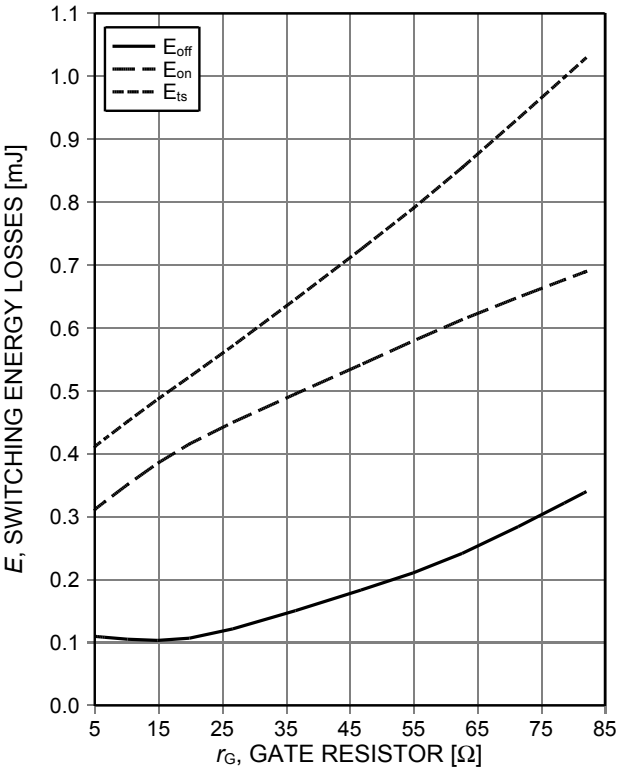



Figure 12. **Typical switching energy losses as a function of gate resistor**
(inductive load, $T_{vj}$=150°C, $V_{CE}$=400V, $V_{GE}$=15/0V, $I_C$=15A, Dynamic test circuit in Figure E)

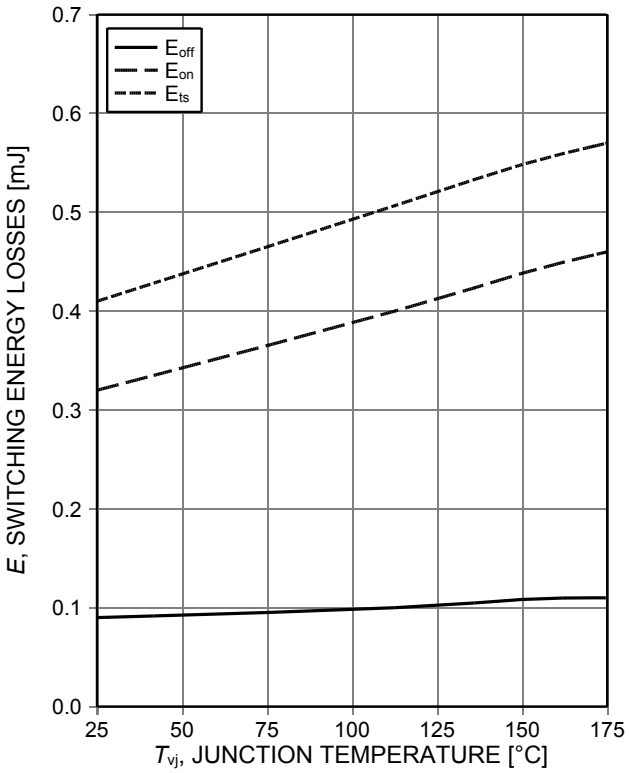



Figure 13. **Typical switching energy losses as a function of junction temperature** (inductive load, $V_{CE}$=400V, $V_{GE}$=15/0V, $I_C$=15A, $r_G$=23Ω,Dynamic test circuit in Figure E)

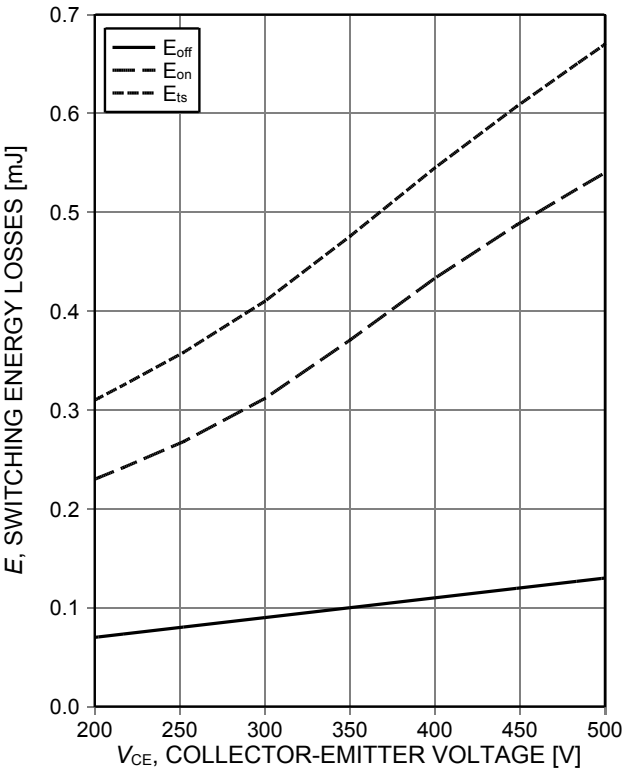



Figure 14. **Typical switching energy losses as a function of collector emitter voltage** (inductive load, $T_{vj}$= 150°C, $V_{GE}$=15/0V, $I_C$=15A, $r_G$=23Ω,Dynamic test circuit in Figure E)

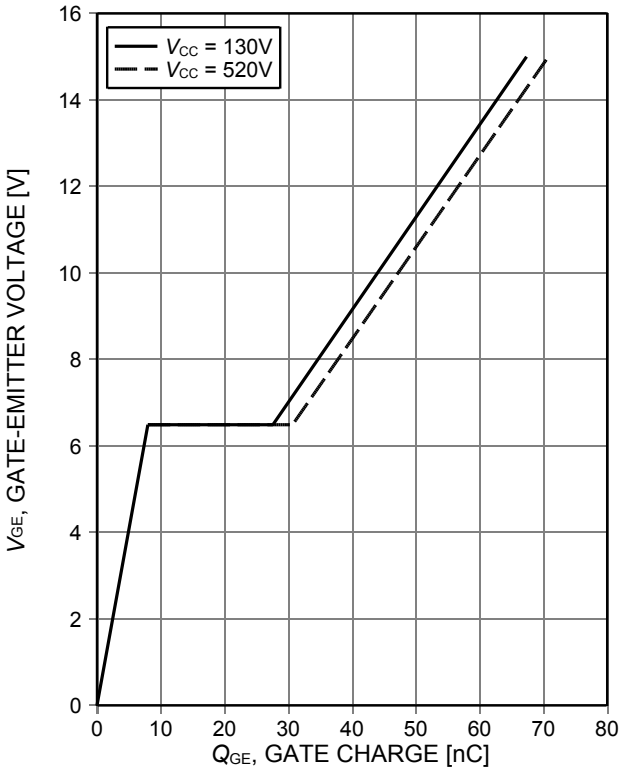



Figure 15. **Typical gate charge** ($I_C$=30A)

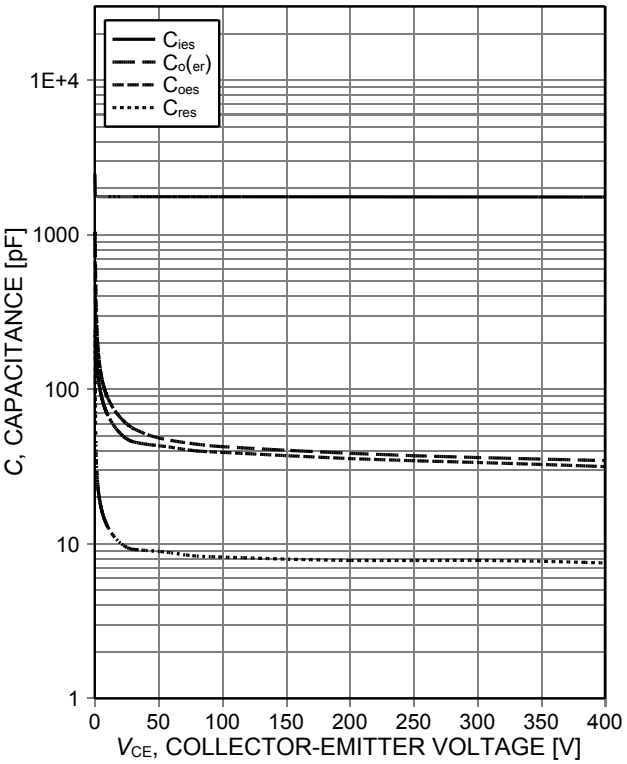



Figure 16. **Typical capacitance as a function of collector-emitter voltage** ($V_{GE}$=0V, f=1MHz)

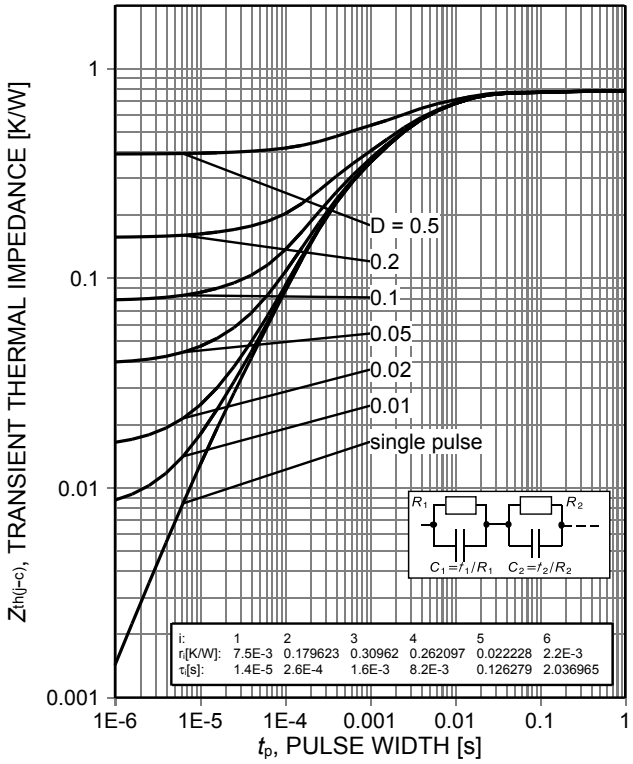
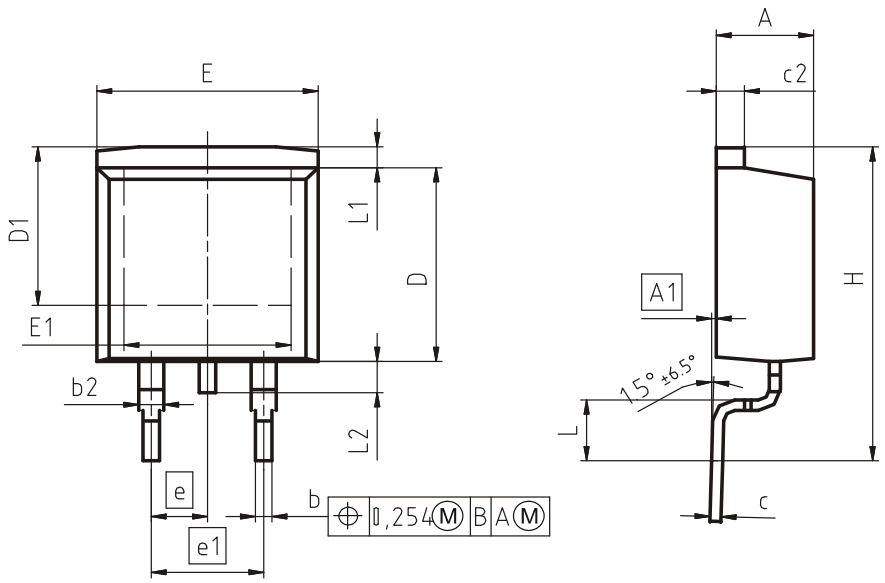
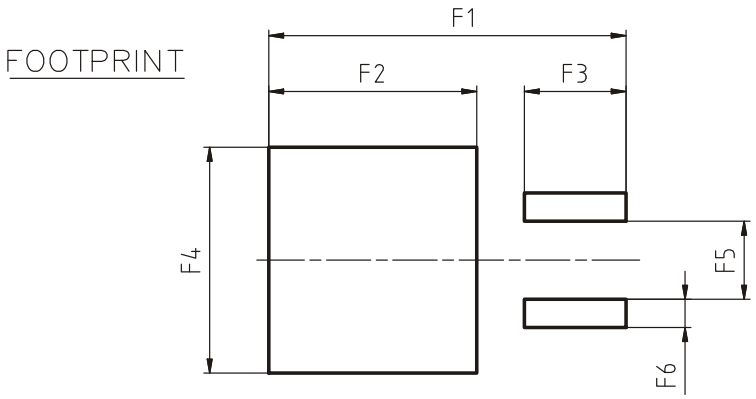



Figure 17. **IGBT transient thermal impedance** ($D$=$t_p$/T)

## Package Drawing PG-TO263-3



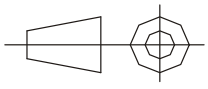




| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 4.30 | 4.57 | 0.169 | 0.180 |
| A1 | 0.00 | 0.25 | 0.000 | 0.010 |
| b | 0.65 | 0.85 | 0.026 | 0.033 |
| b2 | 0.95 | 1.15 | 0.037 | 0.045 |
| c | 0.33 | 0.65 | 0.013 | 0.026 |
| c2 | 1.17 | 1.40 | 0.046 | 0.055 |
| 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
0 5 5
7.5mm

EUROPEAN PROJECTION



ISSUE DATE
30-08-2007

REVISION
01

### Testing Conditions

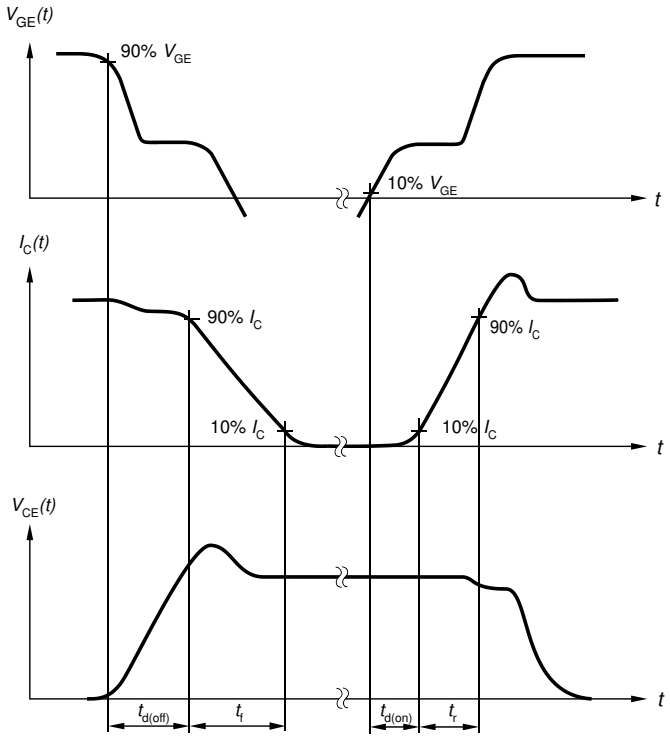



Figure A. **Definition of switching times**

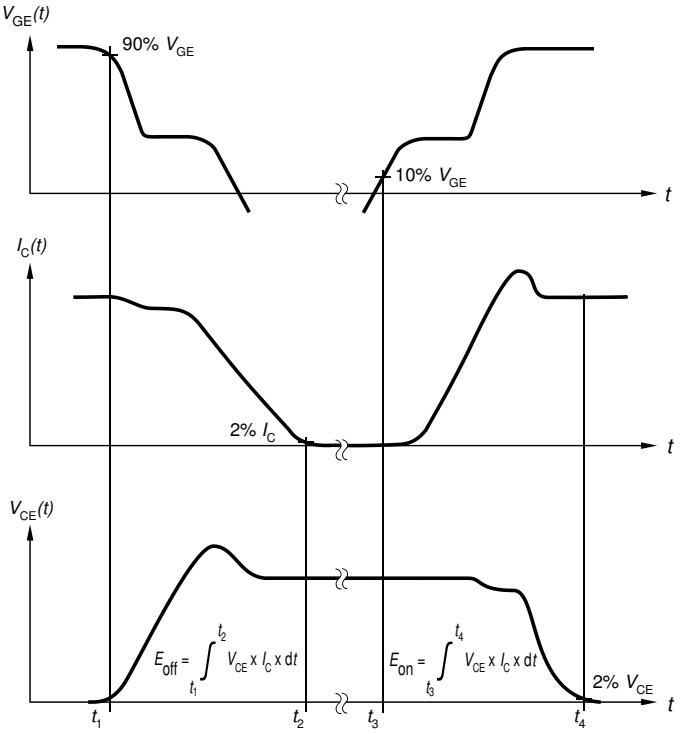



Figure B. **Definition of switching losses**

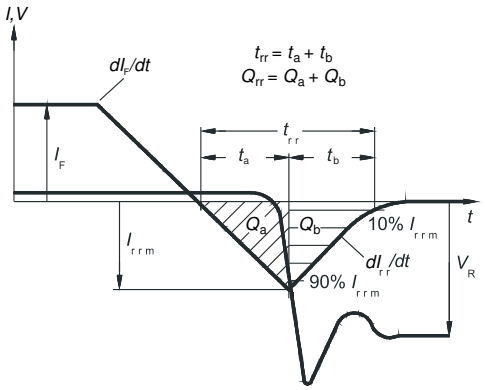



Figure C. **Definition of diode switching characteristics**

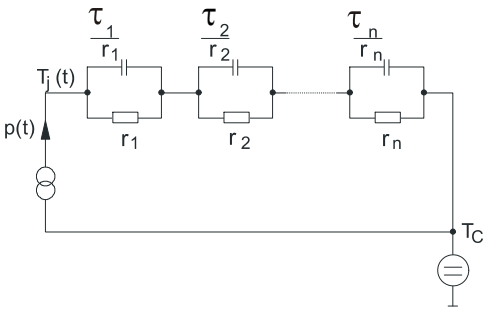



Figure D. **Thermal equivalent circuit**

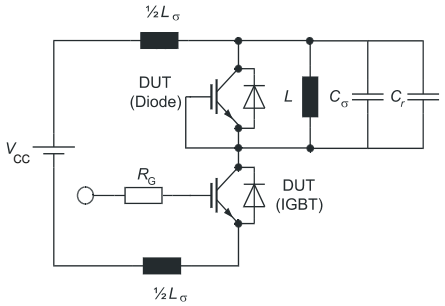



Figure E. **Dynamic test circuit**
Parasitic inductance $L_\sigma$,
parasitic capacitor $C_\sigma$,
relief capacitor $C_r$,
(only for ZVT switching)

## Revision History

AIGB30N65H5

**Revision: 2019-10-18, Rev. 2.1**

Previous Revision

| Revision | Date | Subjects (major changes since last revision) |
|---|---|---|
| 2.1 | 2019-10-18 | Final Datasheet |

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