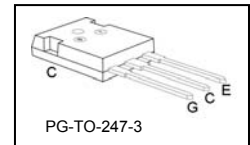
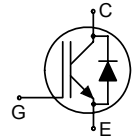


Low Loss DuoPack : IGBT in TrenchStop® and Fieldstop technology with anti-parallel diode

Features:

- 1.1V Forward voltage of antiparallel diode
- TrenchStop® and Fieldstop technology for 900 V applications offers :
 - very tight parameter distribution
 - high ruggedness, temperature stable behavior
 - easy parallel switching capability due to positive temperature coefficient in $V_{CE(sat)}$
- Low EMI
- Qualified according to JEDEC¹ for target applications
- Application specific optimisation of inverse diode
- Pb-free lead plating; RoHS compliant



Applications:

- Microwave Oven
- Soft Switching Applications for ZCS

| Type | V_{CE} | I_C | $V_{CE(sat), T_j=25^\circ C}$ | $T_{j,max}$ | Marking | Package |
|-----------|----------|-------|-------------------------------|-------------|---------|-------------|
| IHW30N90T | 900V | 30A | 1.5V | 175°C | H30T90 | PG-TO-247-3 |

Maximum Ratings

| Parameter | Symbol | Value | Unit |
|---|-------------|------------|------|
| Collector-emitter voltage | V_{CE} | 900 | V |
| DC collector current | I_C | 60 30 | A |
| $T_C = 25^\circ C$ | | | |
| $T_C = 100^\circ C$ | | | |
| Pulsed collector current, t_p limited by T_{jmax} | I_{Cpuls} | 90 | |
| Turn off safe operating area $V_{CE} \leq 900V, T_j \leq 175^\circ C$ | - | 90 | |
| Diode forward current | I_F | 23 13 | |
| $T_C = 25^\circ C$ | | | |
| $T_C = 100^\circ C$ | | | |
| Diode pulsed current, t_p limited by T_{jmax} | I_{Fpuls} | 36 | |
| Gate-emitter voltage | V_{GE} | ± 20 | V |
| Transient Gate-emitter voltage ($t_p < 5$ ms) | | ± 25 | |
| Power dissipation, $T_C = 25^\circ C$ | P_{tot} | 428 | W |
| Operating junction temperature | T_j | -40...+175 | °C |
| Storage temperature | T_{stg} | -55...+175 | °C |
| Soldering temperature, 1.6mm (0.063 in.) from case for 10s | - | 260 | |

¹ J-STD-020 and JESD-022

Thermal Resistance

| Parameter | Symbol | Conditions | Max. Value | Unit |
|--|-------------|------------|------------|------|
| Characteristic | | | | |
| IGBT thermal resistance, junction – case | R_{thJC} | | 0.35 | K/W |
| Diode thermal resistance, junction – case | R_{thJCD} | | 1.1 | |
| Thermal resistance, junction – ambient | R_{thJA} | | 40 | |

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

| Parameter | Symbol | Conditions | Value | | | Unit |
|--------------------------------------|---------------|---|-------|-------------------|---------------|---------|
| | | | min. | Typ. | max. | |
| Static Characteristic | | | | | | |
| Collector-emitter breakdown voltage | $V_{(BR)CES}$ | $V_{GE}=0V, I_C=500\mu A$ | 900 | - | - | V |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $V_{GE} = 15V, I_C=30A$ $T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$ $T_j=175^\circ\text{C}$ | - | 1.5 1.7 1.8 | 1.7 - - | |
| Diode forward voltage | V_F | $V_{GE}=0V, I_F=10A$ $T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$ $T_j=175^\circ\text{C}$ | - | 1.1 1.0 1.0 | 1.3 - - | |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | $I_C=150\mu A, V_{CE}=V_{GE}$ | 4.6 | 5.3 | 6 | |
| Zero gate voltage collector current | I_{CES} | $V_{CE}=900V,$ $V_{GE}=0V$ $T_j=25^\circ\text{C}$ $T_j=150^\circ\text{C}$ | - | - | 250 2500 | μA |
| Gate-emitter leakage current | I_{GES} | $V_{CE}=0V, V_{GE}=20V$ | - | - | 600 | nA |
| Transconductance | g_{fs} | $V_{CE}=20V, I_C=20A$ | - | 26 | - | S |

Dynamic Characteristic

| | | | | | | |
|---|------------|--|---|------|---|----|
| Input capacitance | C_{iss} | $V_{CE}=25V,$ $V_{GE}=0V,$ $f=1\text{MHz}$ | - | 2617 | - | pF |
| Output capacitance | C_{oss} | | - | 96 | - | |
| Reverse transfer capacitance | C_{riss} | | - | 38 | - | |
| Gate charge | Q_{Gate} | $V_{CC}=720V, I_C=30A$ $V_{GE}=15V$ | - | 280 | - | nC |
| Internal emitter inductance measured 5mm (0.197 in.) from case | L_E | | - | 13 | - | nH |

Switching Characteristic, Inductive Load, at $T_j=25\text{ °C}$

| Parameter | Symbol | Conditions | Value | | | Unit |
|----------------------------|--------------|--|-------|------|------|------|
| | | | min. | Typ. | max. | |
| IGBT Characteristic | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $T_j=25\text{ °C}$, $V_{CC}=600\text{V}$, $I_C=30\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=15\Omega$, | - | 45 | - | ns |
| Rise time | t_r | | - | 26 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 556 | - | |
| Fall time | t_f | | - | 29 | - | |
| Turn-on energy | E_{on} | | - | - | - | mJ |
| Turn-off energy | E_{off} | | - | 1.8 | - | |
| Total switching energy | E_{ts} | | - | 1.8 | - | |

Switching Characteristic, Inductive Load, at $T_j=175\text{ °C}$

| Parameter | Symbol | Conditions | Value | | | Unit |
|----------------------------|--------------|--|-------|------|------|------|
| | | | min. | Typ. | max. | |
| IGBT Characteristic | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $T_j=175\text{ °C}$ $V_{CC}=600\text{V}$, $I_C=30\text{A}$, $V_{GE}=0/15\text{V}$, $R_G=15\Omega$ | - | 44 | - | ns |
| Rise time | t_r | | - | 38 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 650 | - | |
| Fall time | t_f | | - | 41 | - | |
| Turn-on energy | E_{on} | | - | - | - | mJ |
| Turn-off energy | E_{off} | | - | 2.4 | - | |
| Total switching energy | E_{ts} | | - | 2.4 | - | |

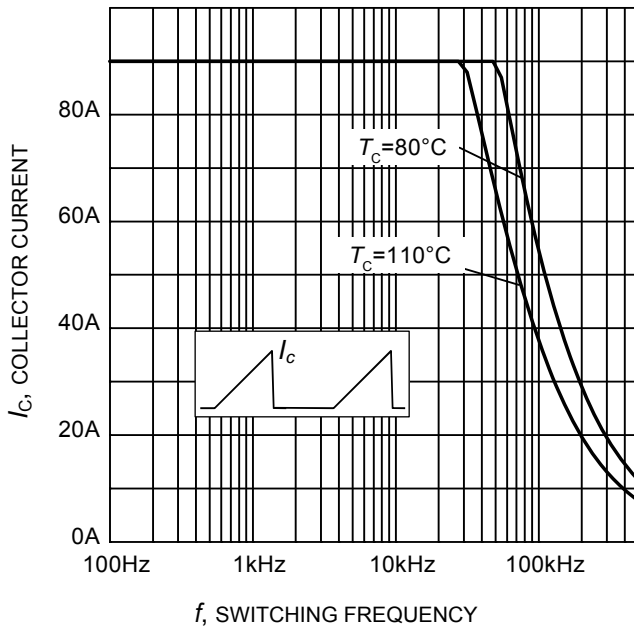


Figure 1. Collector current as a function of switching frequency for triangular current ($E_{on} = 0$, hard turn-off)
 ($T_j \leq 175^\circ\text{C}$, $D = 0.5$, $V_{CE} = 600\text{V}$, $V_{GE} = 0/+15\text{V}$, $R_G = 15\Omega$)

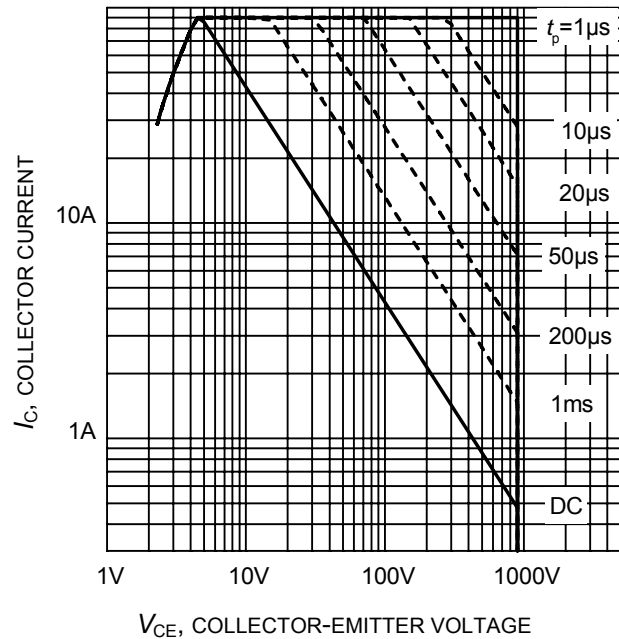


Figure 2. IGBT Safe operating area
 ($D = 0$, $T_C = 25^\circ\text{C}$, $T_j \leq 175^\circ\text{C}$; $V_{GE} = 15\text{V}$)

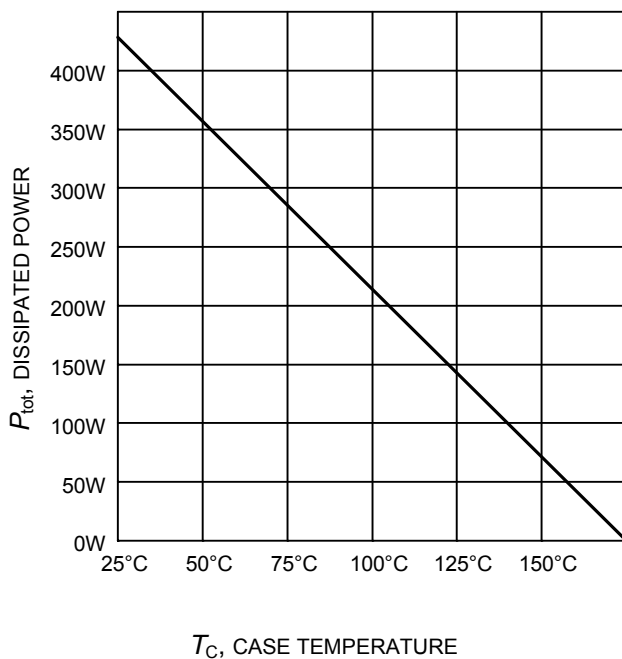


Figure 3. Power dissipation as a function of case temperature
 ($T_j \leq 175^\circ\text{C}$)

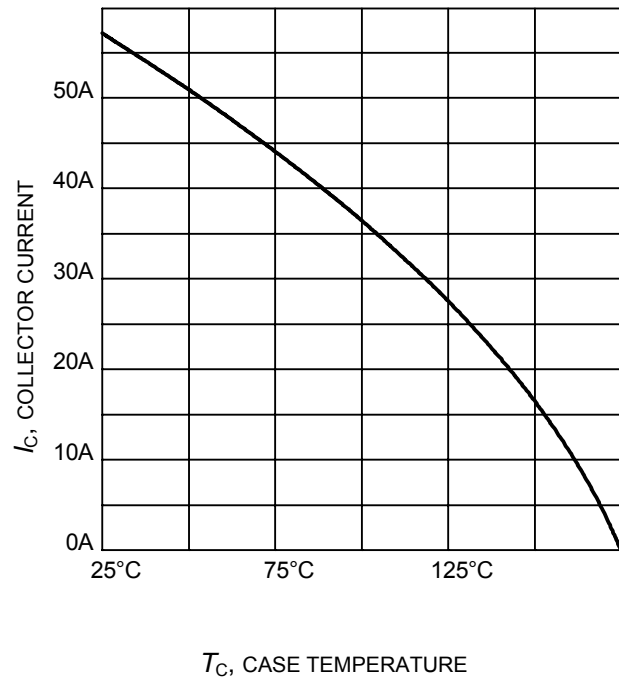


Figure 4. Collector current as a function of case temperature
 ($V_{GE} \geq 15\text{V}$, $T_j \leq 175^\circ\text{C}$)

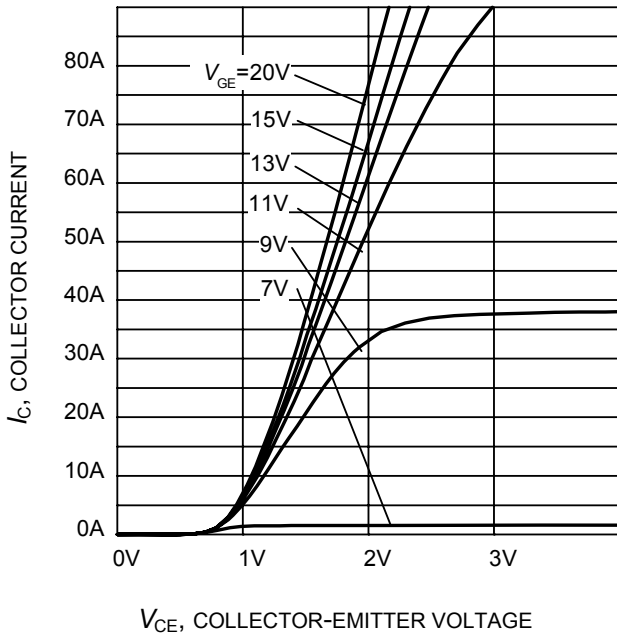


Figure 5. Typical output characteristic
($T_j = 25^\circ\text{C}$)

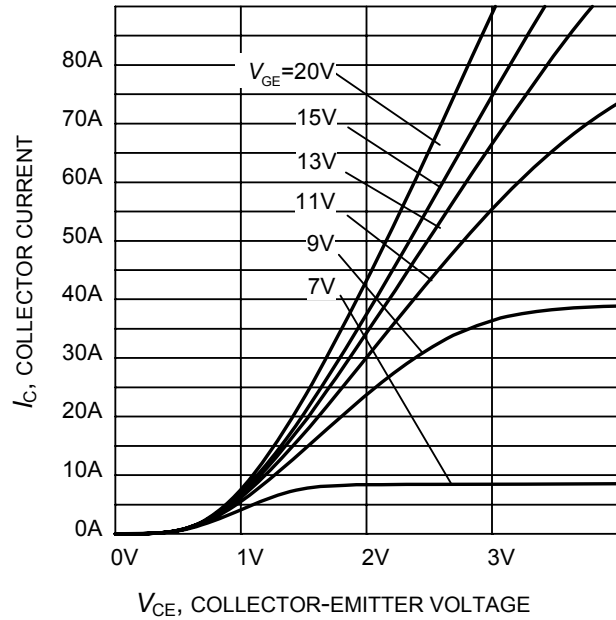


Figure 6. Typical output characteristic
($T_j = 175^\circ\text{C}$)

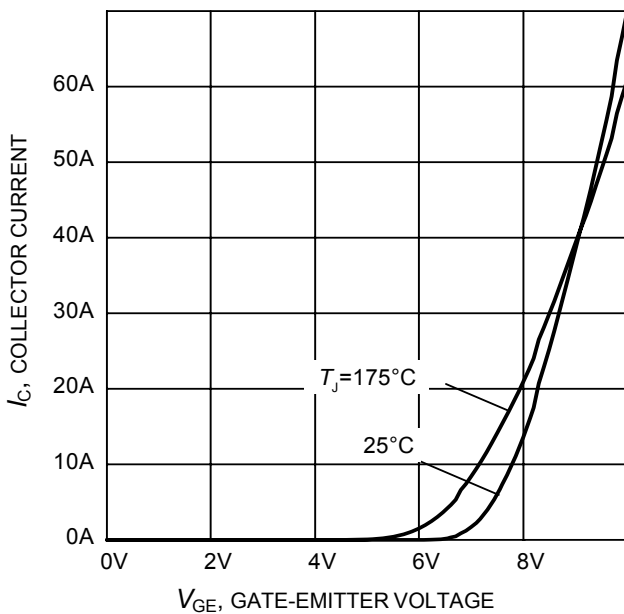


Figure 7. Typical transfer characteristic
($V_{CE} = 20\text{V}$)

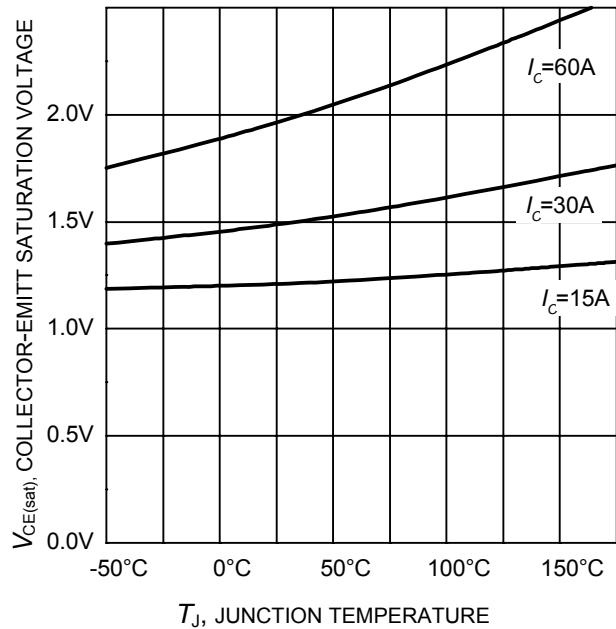


Figure 8. Typical collector-emitter saturation voltage as a function of junction temperature
($V_{GE} = 15\text{V}$)

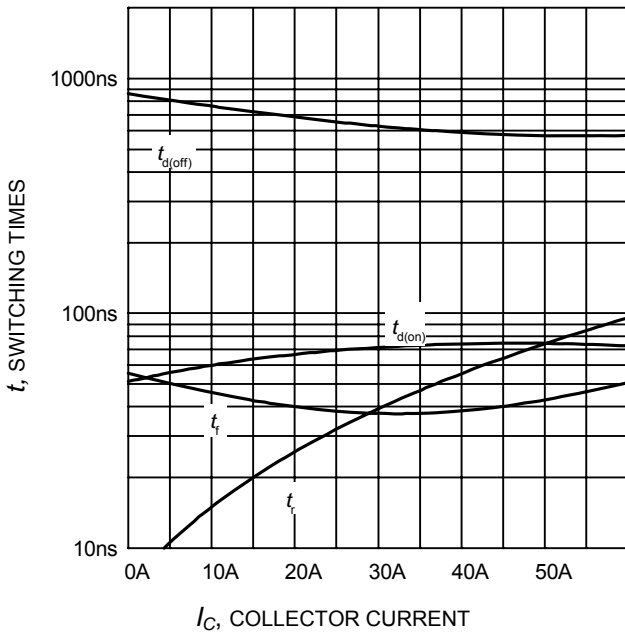


Figure 9. Typical switching times as a function of collector current
 (inductive load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=15\Omega$,
 Dynamic test circuit in Figure E)

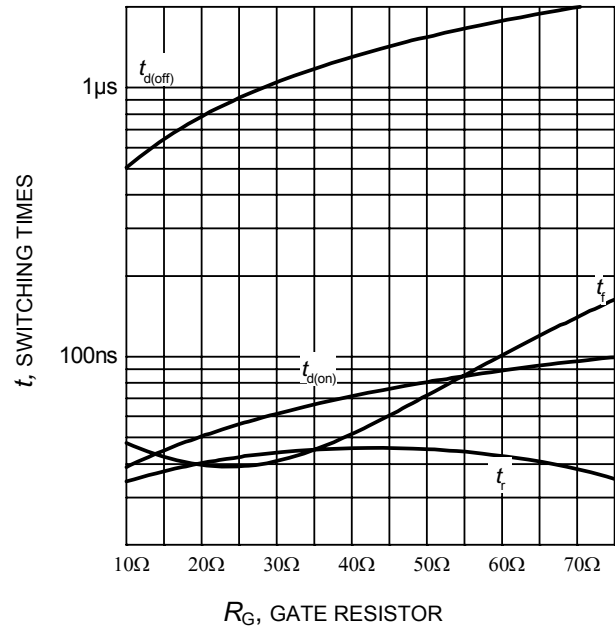


Figure 10. Typical switching times as a function of gate resistor
 (inductive load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$,
 Dynamic test circuit in Figure E)

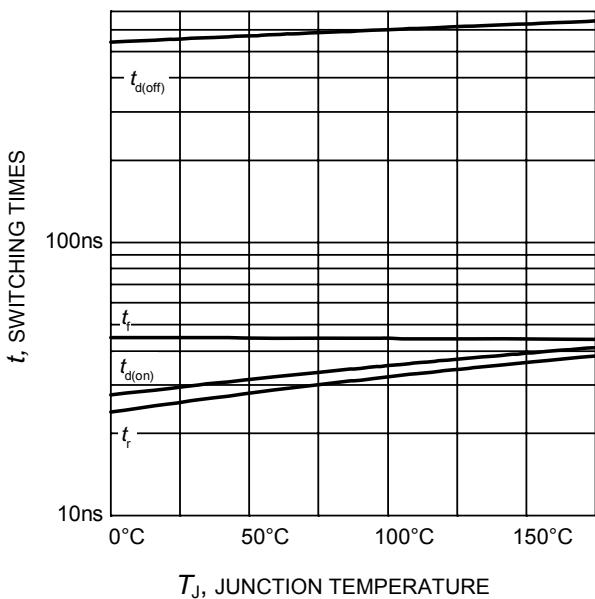


Figure 11. Typical switching times as a function of junction temperature
 (inductive load, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$, $R_G=15\Omega$,
 Dynamic test circuit in Figure E)

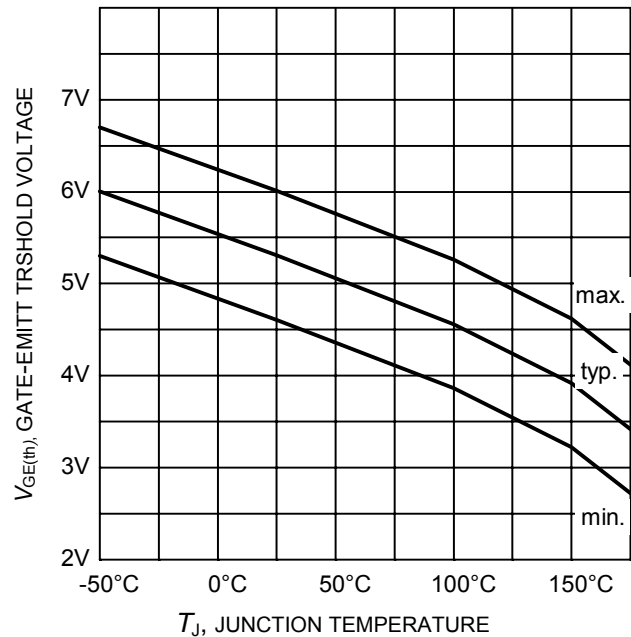


Figure 12. Gate-emitter threshold voltage as a function of junction temperature
 ($I_C = 0.3\text{mA}$)

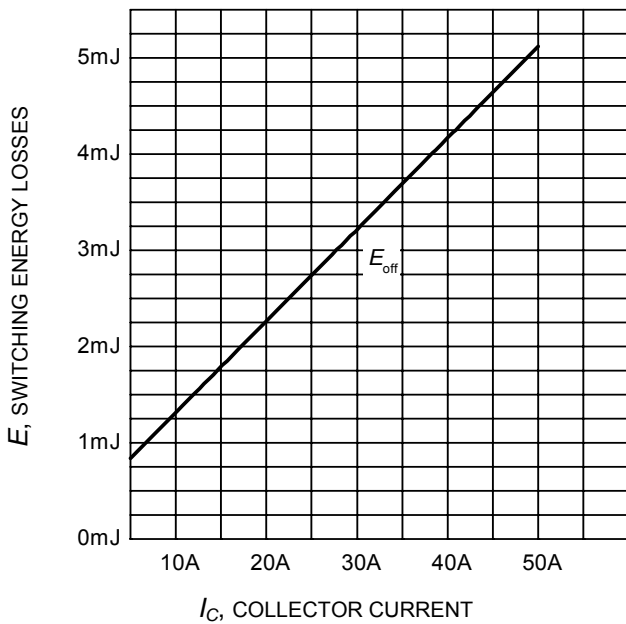


Figure 13. Typical switching energy losses as a function of collector current
(inductive load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=15\Omega$, Dynamic test circuit in Figure E)

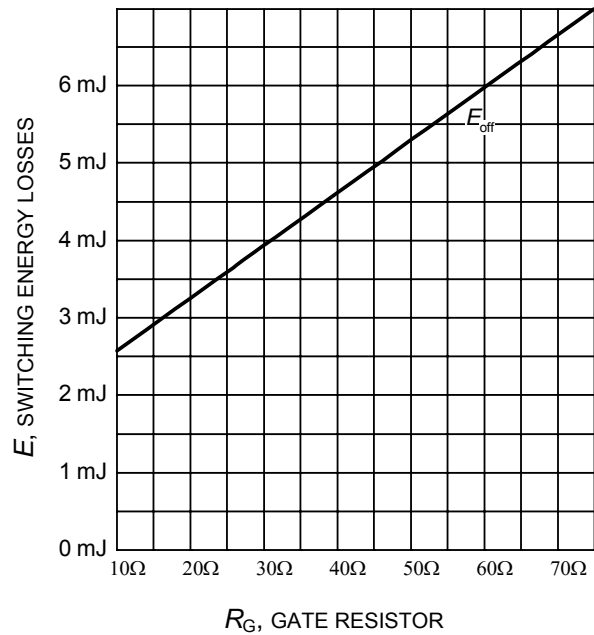


Figure 14. Typical switching energy losses as a function of gate resistor
(inductive load, $T_J=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$, Dynamic test circuit in Figure E)

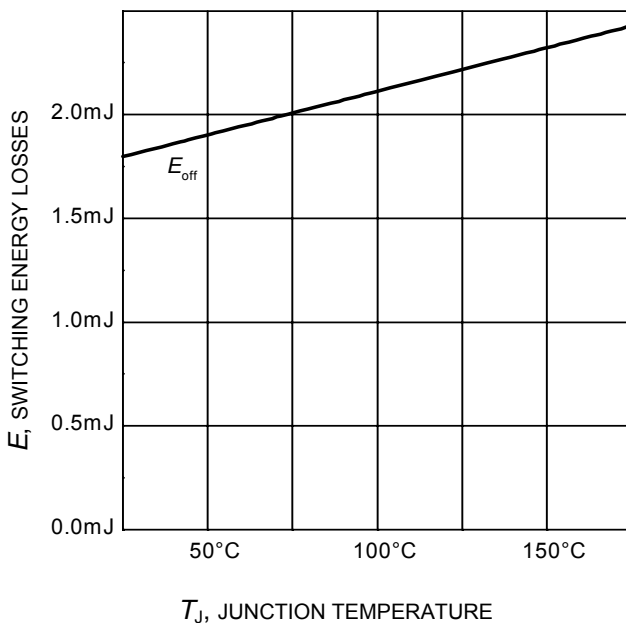


Figure 15. Typical switching energy losses as a function of junction temperature
(inductive load, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$, $R_G=15\Omega$, Dynamic test circuit in Figure E)

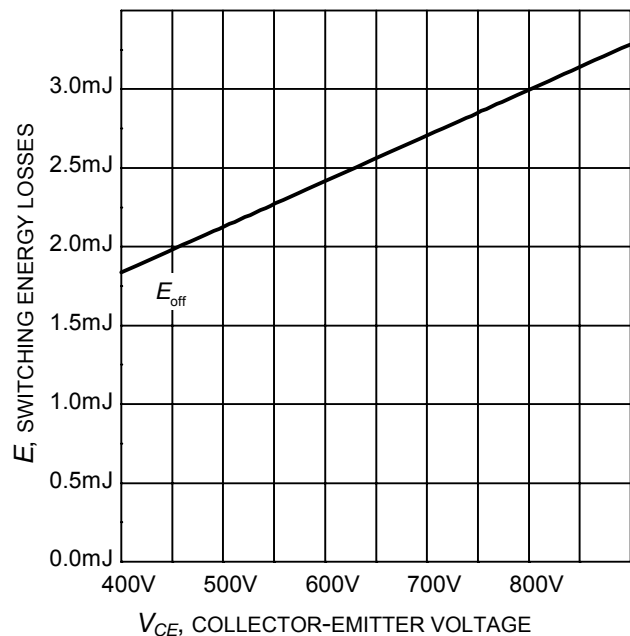


Figure 16. Typical switching energy losses as a function of collector emitter voltage
(inductive load, $T_J=175^\circ\text{C}$, $V_{GE}=0/15\text{V}$, $I_C=30\text{A}$, $R_G=15\Omega$, Dynamic test circuit in Figure E)

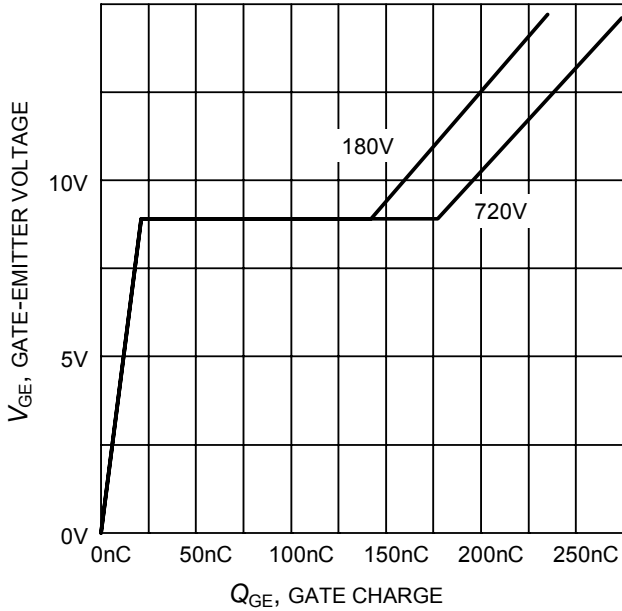


Figure 17. Typical gate charge
($I_C=30\text{ A}$)

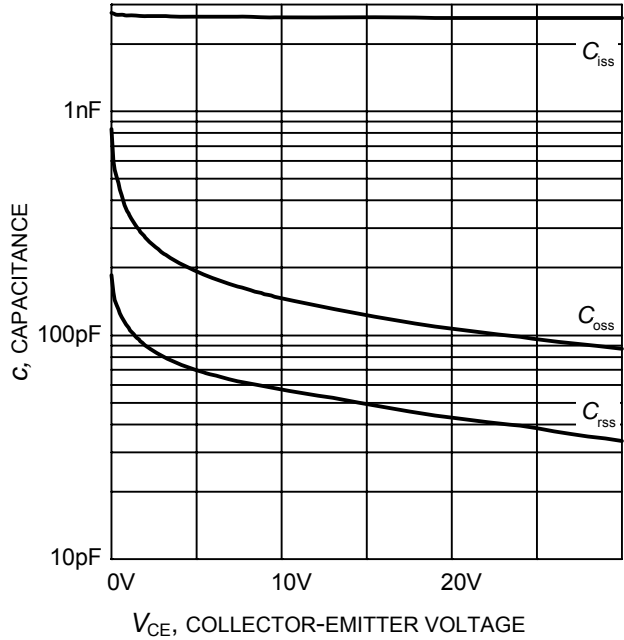


Figure 18. Typical capacitance as a function of collector-emitter voltage
($V_{GE}=0\text{V}$, $f=1\text{ MHz}$)

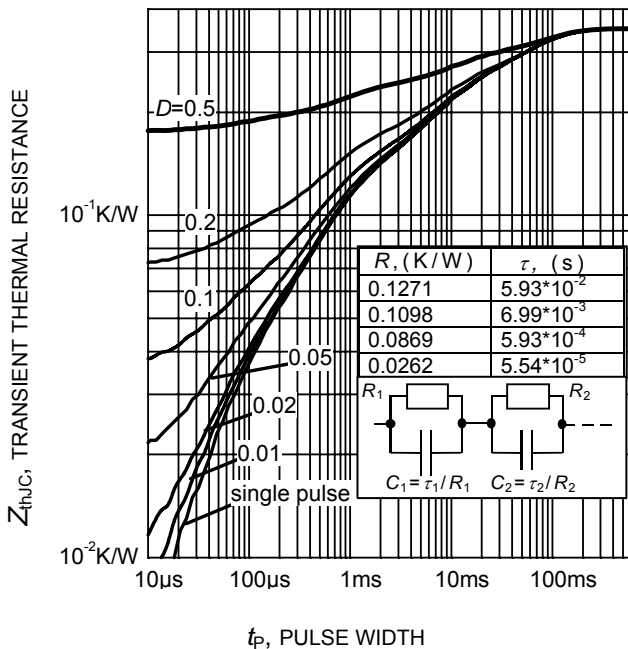


Figure 19. IGBT transient thermal resistance
($D = t_p / T$)

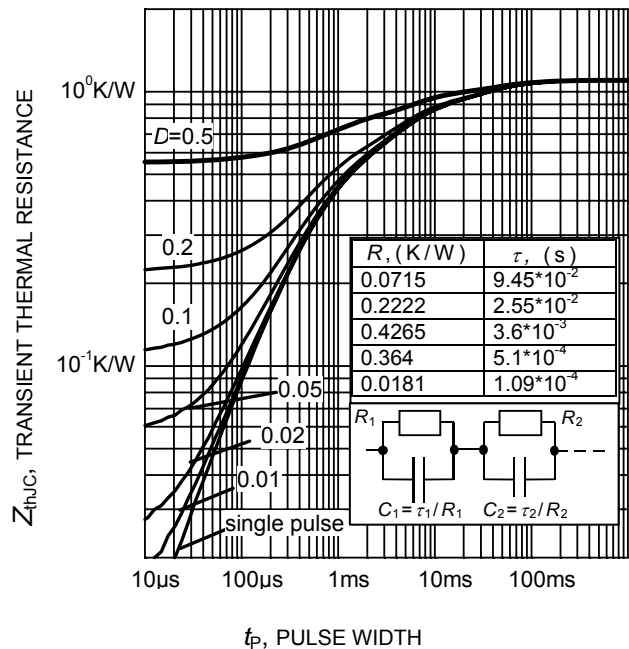


Figure 20. Typical Diode transient thermal impedance as a function of pulse width
($D = t_p / T$)

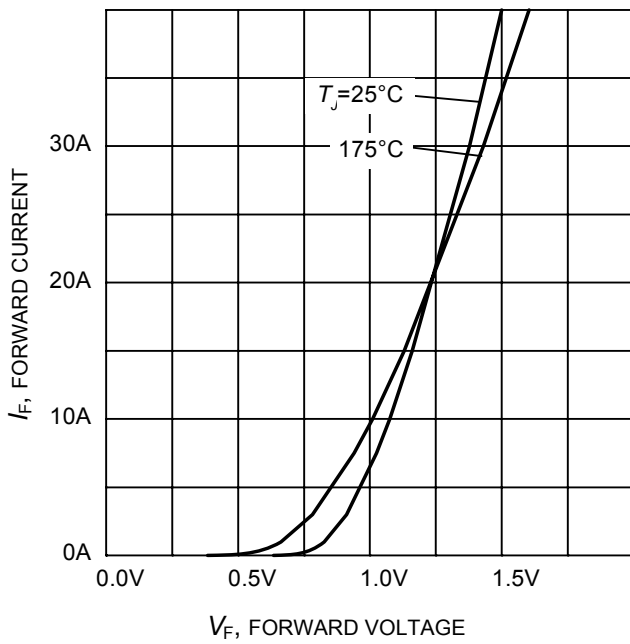


Figure 21. Typical diode forward current as a function of forward voltage

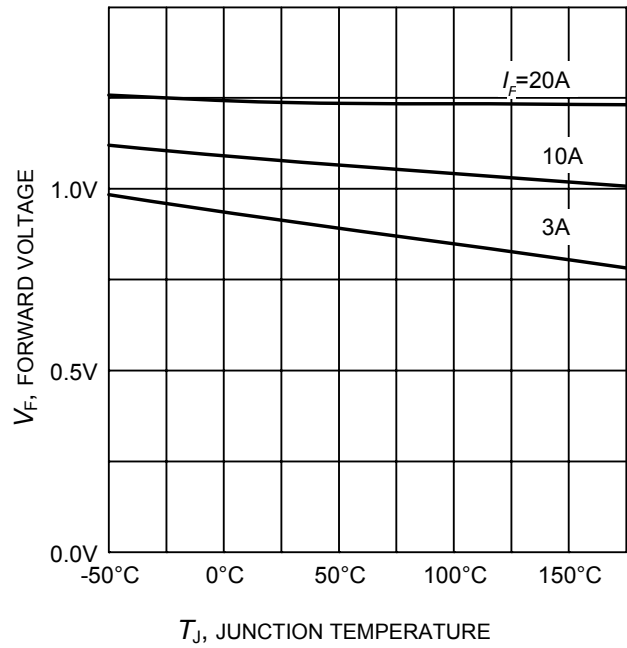
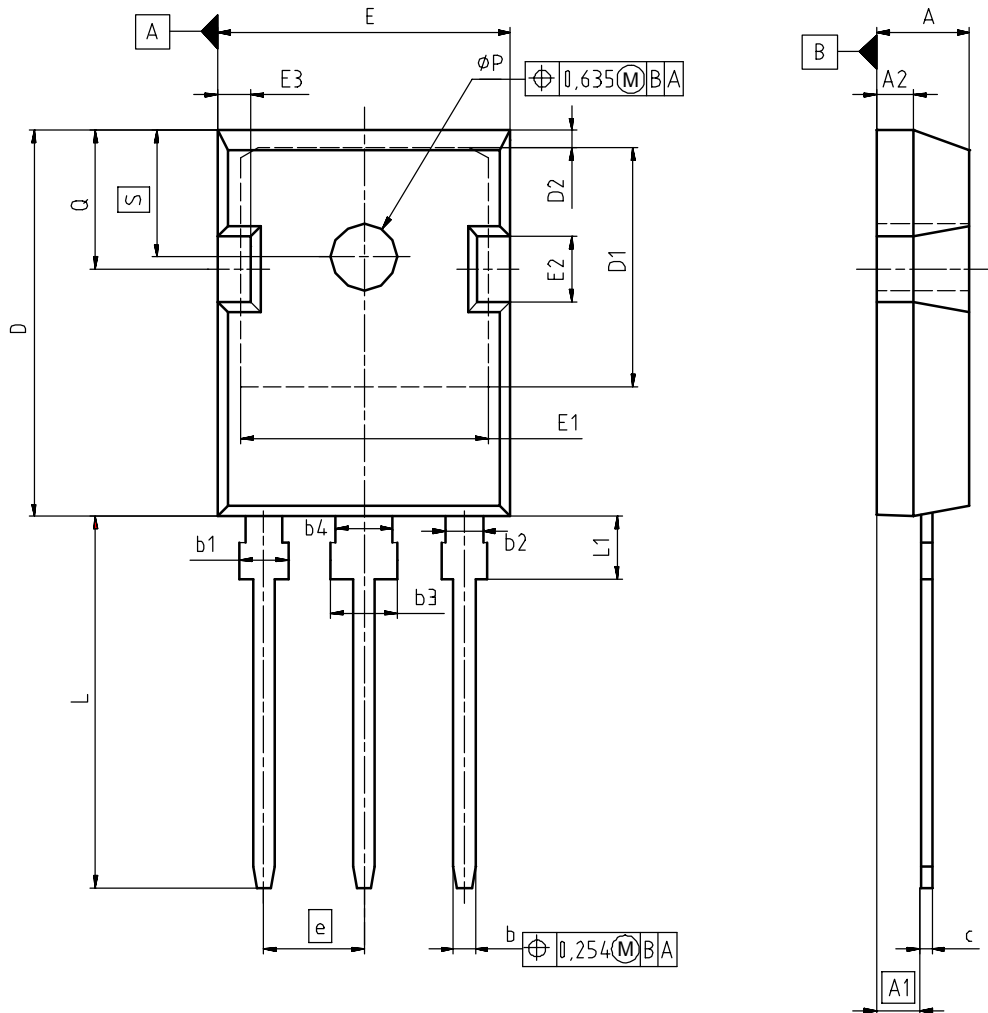


Figure 22. Typical diode forward voltage as a function of junction temperature

PG-TO247-3



| DIM | MILLIMETERS | | INCHES | |
|----------|-------------|-------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 4.90 | 5.16 | 0.193 | 0.203 |
| A1 | 2.27 | 2.53 | 0.089 | 0.099 |
| A2 | 1.85 | 2.11 | 0.073 | 0.083 |
| b | 1.07 | 1.33 | 0.042 | 0.052 |
| b1 | 1.90 | 2.41 | 0.075 | 0.095 |
| b2 | 1.90 | 2.16 | 0.075 | 0.085 |
| b3 | 2.87 | 3.38 | 0.113 | 0.133 |
| b4 | 2.87 | 3.13 | 0.113 | 0.123 |
| c | 0.55 | 0.68 | 0.022 | 0.027 |
| D | 20.82 | 21.10 | 0.820 | 0.831 |
| D1 | 16.25 | 17.65 | 0.640 | 0.695 |
| D2 | 1.05 | 1.35 | 0.041 | 0.053 |
| E | 15.70 | 16.03 | 0.618 | 0.631 |
| E1 | 13.10 | 14.15 | 0.516 | 0.557 |
| E2 | 3.68 | 5.10 | 0.145 | 0.201 |
| E3 | 1.68 | 2.60 | 0.066 | 0.102 |
| e | 5.44 | | 0.214 | |
| N | 3 | | 3 | |
| L | 19.80 | 20.31 | 0.780 | 0.799 |
| L1 | 4.17 | 4.47 | 0.164 | 0.176 |
| ϕP | 3.50 | 3.70 | 0.138 | 0.146 |
| Q | 5.49 | 6.00 | 0.216 | 0.236 |
| S | 6.04 | 6.30 | 0.238 | 0.248 |

DOCUMENT NO.
Z8B00003327

SCALE

EUROPEAN PROJECTION

ISSUE DATE
17-12-2007

REVISION
03

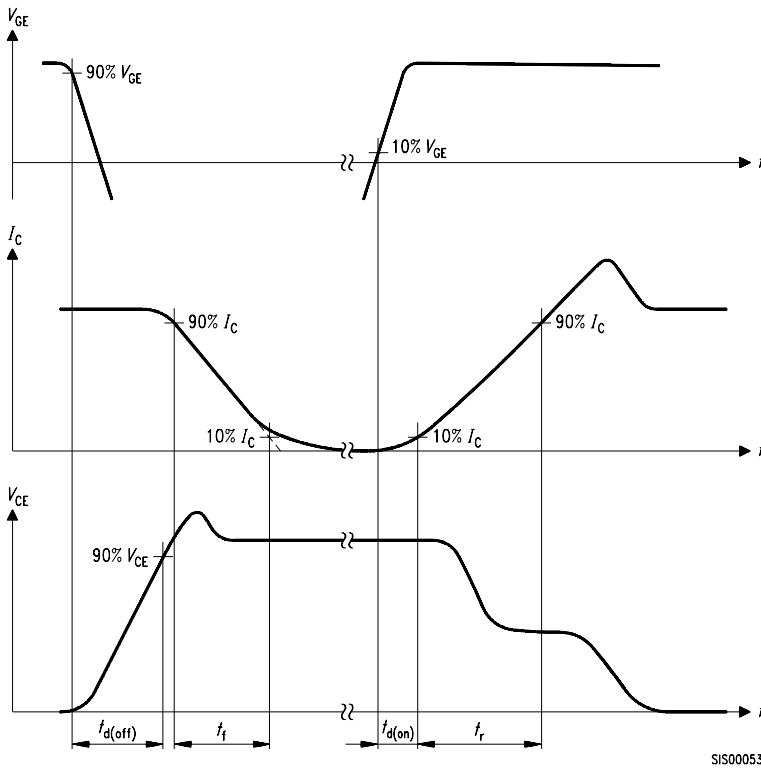


Figure A. Definition of switching times

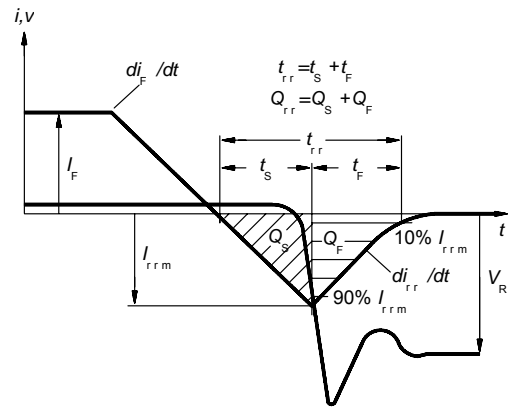


Figure C. Definition of diodes switching characteristics

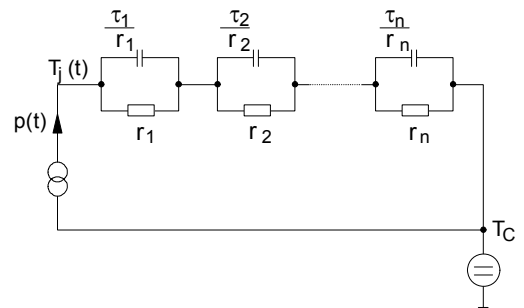


Figure D. Thermal equivalent circuit

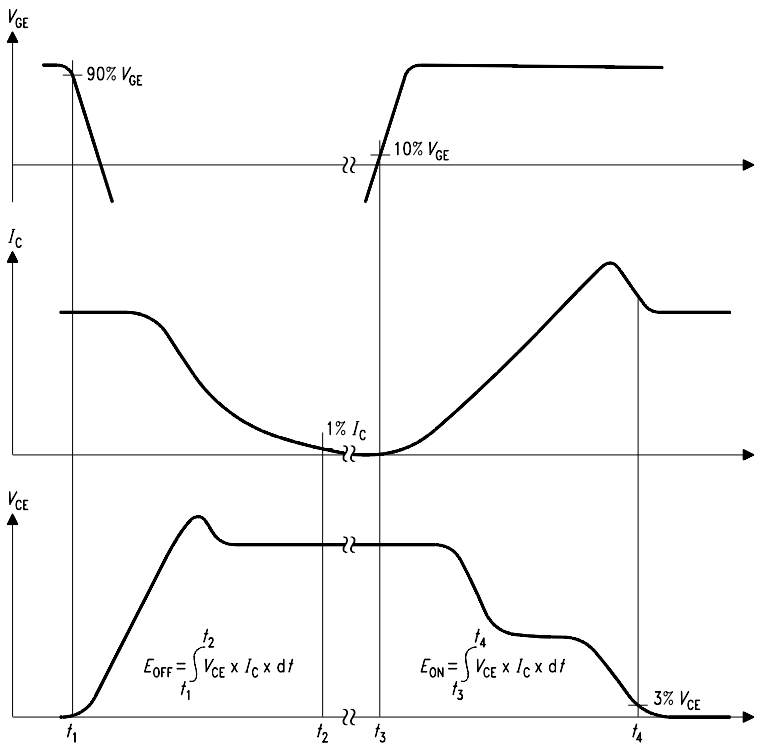


Figure B. Definition of switching losses

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Infineon Technologies AG
81726 Munich, Germany
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