

## Diode

Rapid Switching Emitter Controlled Diode

## IDW80C65D2

Emitter Controlled Diode Rapid 2 Common Cathode Series

Data sheet

## Rapid Switching Emitter Controlled Diode

### Features:

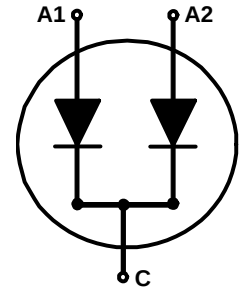
- Qualified according to JEDEC for target applications
- 650V Emitter Controlled technology
- Fast recovery
- Soft switching
- Low reverse recovery charge ( $Q_{rr}$ )
- Low forward voltage ( $V_F$ ) and stable over temperature
- 175°C junction operating temperature
- Easy paralleling
- Pb-free lead plating
- RoHS compliant

### Applications:

- Boost diode in CCM PFC

### Package pin definition:

- Pin 1 - anode (A1)
- Pin 2 and backside - cathode (C)
- Pin 3 - anode (A2)



### Key Performance and Package Parameters

| Type       | $V_{rrm}$ | $I_f$  | $V_f, T_{vj}=25^{\circ}\text{C}$ | $T_{vjmax}$ | Marking | Package    |
|------------|-----------|--------|----------------------------------|-------------|---------|------------|
| IDW80C65D2 | 650V      | 2x 40A | 1.6V                             | 175°C       | C80ED2  | PG-TO247-3 |

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### Maximum Ratings (per leg)

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               |
|-----------------------------------------------------------------------------------------------------------------|-------------|---------------|--------------------|
| Repetitive peak reverse voltage, $T_{vj} \geq 25^{\circ}\text{C}$                                               | $V_{RRM}$   | 650           | V                  |
| Diode forward current, limited by $T_{vjmax}$<br>$T_C = 25^{\circ}\text{C}$<br>$T_C = 100^{\circ}\text{C}$      | $I_F$       | 80.0<br>40.0  | A                  |
| Diode pulsed current, $t_p$ limited by $T_{vjmax}$                                                              | $I_{Fpuls}$ | 120.0         | A                  |
| Diode surge non repetitive forward current<br>$T_C = 25^{\circ}\text{C}$ , $t_p = 8.3\text{ms}$ , sine halfwave | $I_{FSM}$   | 250.0         | A                  |
| Power dissipation $T_C = 25^{\circ}\text{C}$<br>Power dissipation $T_C = 100^{\circ}\text{C}$                   | $P_{tot}$   | 180.0<br>90.0 | W                  |
| Operating junction temperature                                                                                  | $T_{vj}$    | -40...+175    | $^{\circ}\text{C}$ |
| Storage temperature                                                                                             | $T_{stg}$   | -55...+150    | $^{\circ}\text{C}$ |
| Soldering temperature,<br>wave soldering 1.6mm (0.063in.) from case for 10s                                     |             | 260           | $^{\circ}\text{C}$ |
| Mounting torque, M3 screw<br>Maximum of mounting processes: 3                                                   | $M$         | 0.6           | Nm                 |

### Thermal Resistances (per leg)

| Parameter                                                  | Symbol        | Conditions | Max. Value | Unit |
|------------------------------------------------------------|---------------|------------|------------|------|
| <b>Characteristic</b>                                      |               |            |            |      |
| Diode thermal resistance, <sup>1)</sup><br>junction - case | $R_{th(j-c)}$ |            | 0.84       | K/W  |
| Thermal resistance<br>junction - ambient                   | $R_{th(j-a)}$ |            | 40         | K/W  |

### Electrical Characteristics (per leg), at $T_{vj} = 25^{\circ}\text{C}$ , unless otherwise specified

| Parameter                             | Symbol | Conditions                                                                                    | Value       |                      |                | Unit    |
|---------------------------------------|--------|-----------------------------------------------------------------------------------------------|-------------|----------------------|----------------|---------|
|                                       |        |                                                                                               | min.        | typ.                 | max.           |         |
| Static Characteristic                 |        |                                                                                               |             |                      |                |         |
| Diode forward voltage                 | $V_F$  | $I_F = 40.0A$<br>$T_{vj} = 25^{\circ}C$<br>$T_{vj} = 125^{\circ}C$<br>$T_{vj} = 175^{\circ}C$ | -<br>-<br>- | 1.60<br>1.65<br>1.65 | 2.20<br>-<br>- | V       |
| Reverse leakage current <sup>2)</sup> | $I_R$  | $V_R = 650V$<br>$T_{vj} = 25^{\circ}C$<br>$T_{vi} = 175^{\circ}C$                             | -<br>-      | -<br>1600.0          | 40.0<br>-      | $\mu A$ |

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

| Parameter                                                            | Symbol         | Conditions | Value |      |      | Unit |
|----------------------------------------------------------------------|----------------|------------|-------|------|------|------|
|                                                                      |                |            | min.  | typ. | max. |      |
| Dynamic Characteristic                                               |                |            |       |      |      |      |
| Internal emitter inductance<br>measured 5mm (0.197 in.) from<br>case | L <sub>E</sub> |            | -     | 13.0 | -    | nH   |

<sup>1)</sup> Please be aware that in nonstandard load conditions, due to high  $R_{th(j-c)}$ ,  $T_{vj}$  close to  $T_{vjmax}$  can be reached.

<sup>2)</sup> Reverse leakage current per leg specified for operating conditions with zero voltage applied to the other leg.

**Switching Characteristics (per leg), Inductive Load**

| Parameter                                                        | Symbol       | Conditions                                                                                                                                                                                                    | Value |        |      | Unit             |
|------------------------------------------------------------------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|------|------------------|
|                                                                  |              |                                                                                                                                                                                                               | min.  | typ.   | max. |                  |
| Diode Characteristic, at $T_{vj} = 25^{\circ}\text{C}$           |              |                                                                                                                                                                                                               |       |        |      |                  |
| Diode reverse recovery time                                      | $t_{rr}$     | $T_{vj} = 25^{\circ}\text{C}$ ,<br>$V_R = 400\text{V}$ ,<br>$I_F = 40.0\text{A}$ ,<br>$di_F/dt = 1000\text{A}/\mu\text{s}$ ,<br>$L\sigma = 30\text{nH}$ ,<br>$C\sigma = 40\text{pF}$ ,<br>switch IPW60R045CP. | -     | 36     | -    | ns               |
| Diode reverse recovery charge                                    | $Q_{rr}$     |                                                                                                                                                                                                               | -     | 0.40   | -    | $\mu\text{C}$    |
| Diode peak reverse recovery current                              | $I_{rrm}$    |                                                                                                                                                                                                               | -     | 22.0   | -    | A                |
| Diode peak rate of fall of reverse recovery current during $t_b$ | $di_{rr}/dt$ |                                                                                                                                                                                                               | -     | -10000 | -    | A/ $\mu\text{s}$ |
|                                                                  |              |                                                                                                                                                                                                               |       |        |      |                  |
| Diode reverse recovery time                                      | $t_{rr}$     | $T_{vj} = 25^{\circ}\text{C}$ ,<br>$V_R = 400\text{V}$ ,<br>$I_F = 40.0\text{A}$ ,<br>$di_F/dt = 200\text{A}/\mu\text{s}$ ,<br>$L\sigma = 30\text{nH}$ ,<br>$C\sigma = 40\text{pF}$ ,<br>switch IPW60R045CP.  | -     | 68     | -    | ns               |
| Diode reverse recovery charge                                    | $Q_{rr}$     |                                                                                                                                                                                                               | -     | 0.18   | -    | $\mu\text{C}$    |
| Diode peak reverse recovery current                              | $I_{rrm}$    |                                                                                                                                                                                                               | -     | 3.6    | -    | A                |
| Diode peak rate of fall of reverse recovery current during $t_b$ | $di_{rr}/dt$ |                                                                                                                                                                                                               | -     | -660   | -    | A/ $\mu\text{s}$ |

**Switching Characteristics (per leg), Inductive Load**

| Parameter                                                                   | Symbol       | Conditions                                                                                                                                                                                                     | Value |       |      | Unit                   |
|-----------------------------------------------------------------------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|------|------------------------|
|                                                                             |              |                                                                                                                                                                                                                | min.  | typ.  | max. |                        |
| Diode Characteristic, at $T_{vj} = 175^{\circ}\text{C}/125^{\circ}\text{C}$ |              |                                                                                                                                                                                                                |       |       |      |                        |
| Diode reverse recovery time                                                 | $t_{rr}$     | $T_{vj} = 175^{\circ}\text{C}$ ,<br>$V_R = 400\text{V}$ ,<br>$I_F = 40.0\text{A}$ ,<br>$di_F/dt = 1000\text{A}/\mu\text{s}$ ,<br>$L\sigma = 30\text{nH}$ ,<br>$C\sigma = 40\text{pF}$ ,<br>switch IPW60R045CP. | -     | 60    | -    | ns                     |
| Diode reverse recovery charge                                               | $Q_{rr}$     |                                                                                                                                                                                                                | -     | 1.11  | -    | $\mu\text{C}$          |
| Diode peak reverse recovery current                                         | $I_{rrm}$    |                                                                                                                                                                                                                | -     | 32.0  | -    | A                      |
| Diode peak rate of fall of reverse recovery current during $t_b$            | $di_{rr}/dt$ |                                                                                                                                                                                                                | -     | -8700 | -    | $\text{A}/\mu\text{s}$ |
|                                                                             |              |                                                                                                                                                                                                                |       |       |      |                        |
| Diode reverse recovery time                                                 | $t_{rr}$     | $T_{vj} = 125^{\circ}\text{C}$ ,<br>$V_R = 400\text{V}$ ,<br>$I_F = 40.0\text{A}$ ,<br>$di_F/dt = 200\text{A}/\mu\text{s}$ ,<br>$L\sigma = 30\text{nH}$ ,<br>$C\sigma = 40\text{pF}$ ,<br>switch IPW60R045CP.  | -     | 82    | -    | ns                     |
| Diode reverse recovery charge                                               | $Q_{rr}$     |                                                                                                                                                                                                                | -     | 0.44  | -    | $\mu\text{C}$          |
| Diode peak reverse recovery current                                         | $I_{rrm}$    |                                                                                                                                                                                                                | -     | 7.0   | -    | A                      |
| Diode peak rate of fall of reverse recovery current during $t_b$            | $di_{rr}/dt$ |                                                                                                                                                                                                                | -     | -1350 | -    | $\text{A}/\mu\text{s}$ |

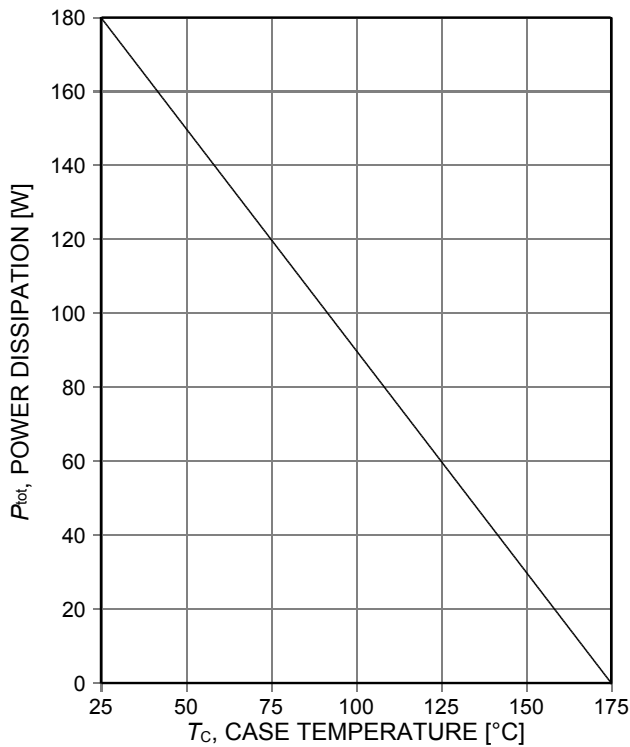


Figure 1. Power dissipation per leg as a function of case temperature ( $T_{vj} \leq 175^\circ\text{C}$ )

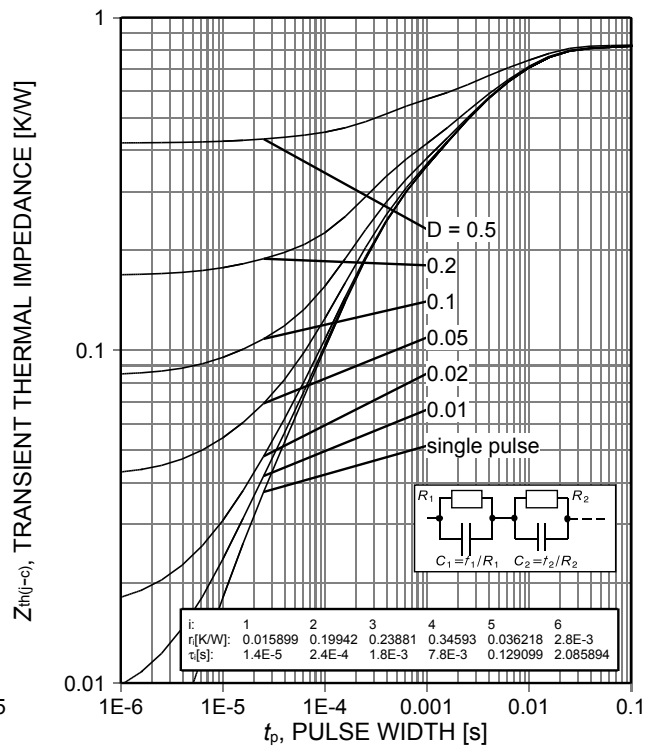


Figure 2. Diode transient thermal impedance per leg as a function of pulse width ( $D = t_p/T$ )

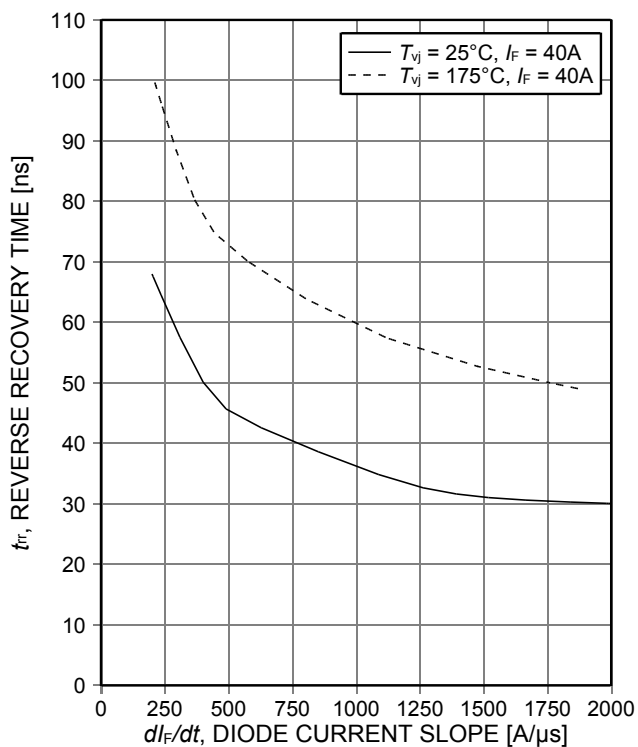


Figure 3. Typical reverse recovery time per leg as a function of diode current slope ( $V_R = 400\text{V}$ )

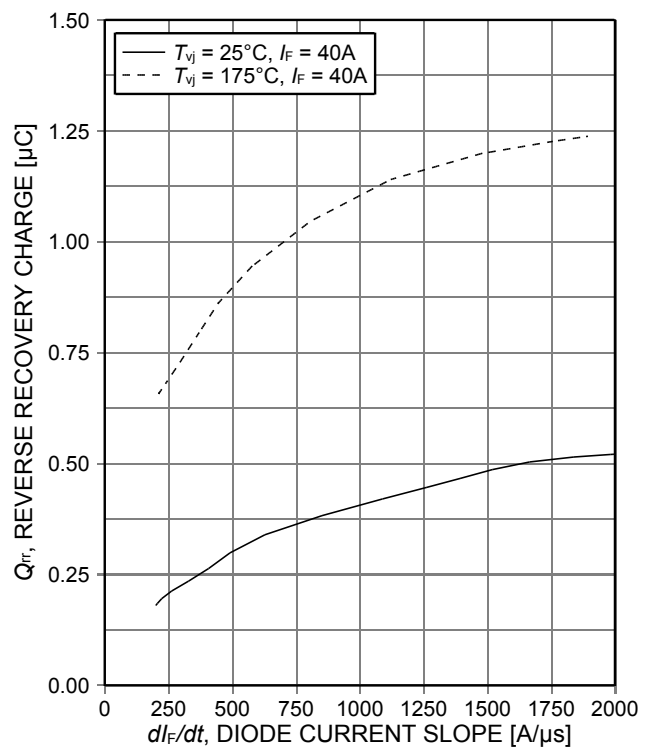


Figure 4. Typical reverse recovery charge per leg as a function of diode current slope ( $V_R = 400\text{V}$ )

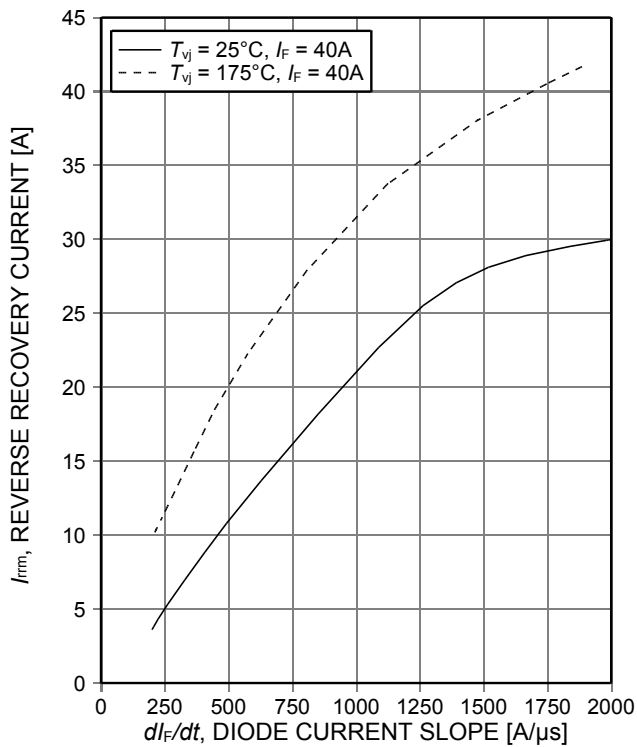


Figure 5. Typical peak reverse recovery current per leg as a function of diode current slope ( $V_R=400V$ )

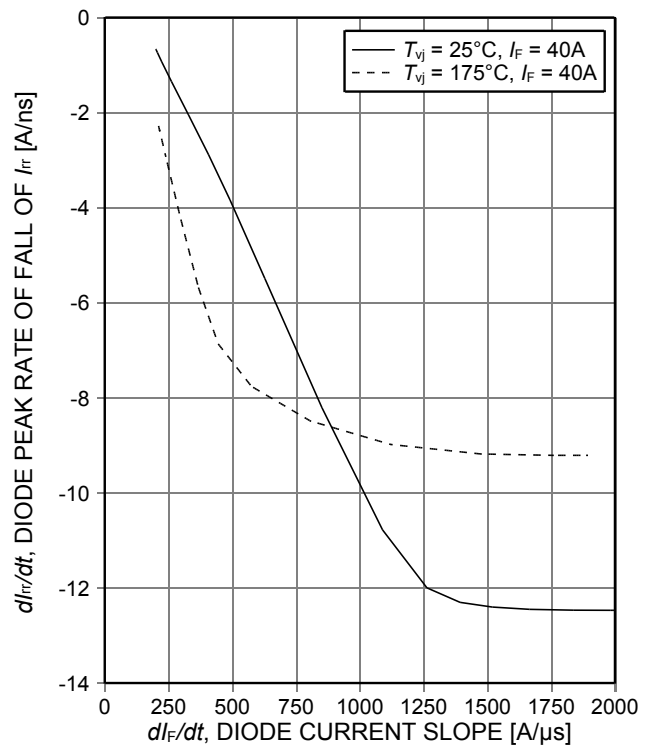


Figure 6. Typical diode peak rate of fall of rev. rec. current per leg as a function of diode current slope ( $V_R=400V$ )

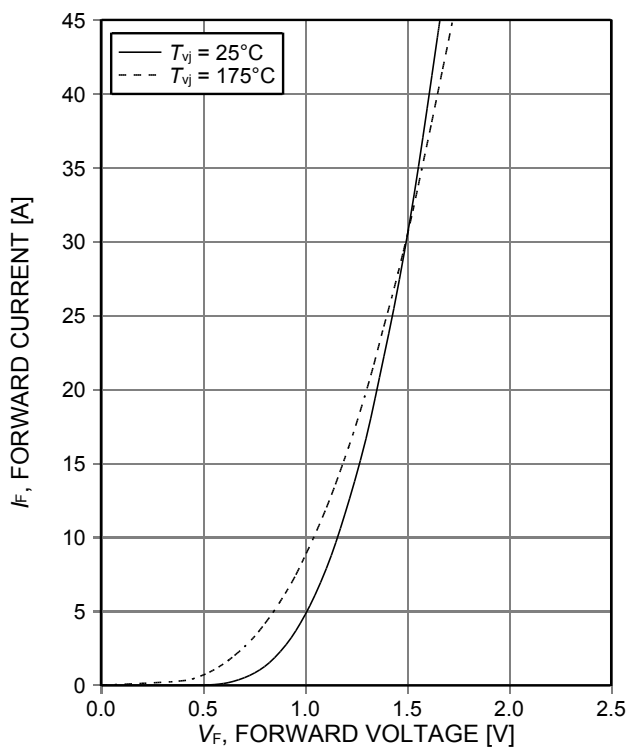


Figure 7. Typical diode forward current per leg as a function of forward voltage

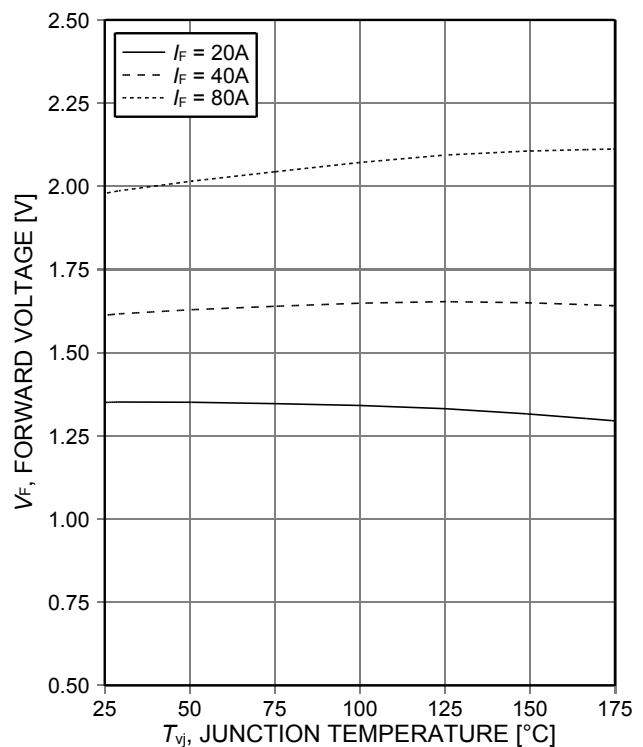
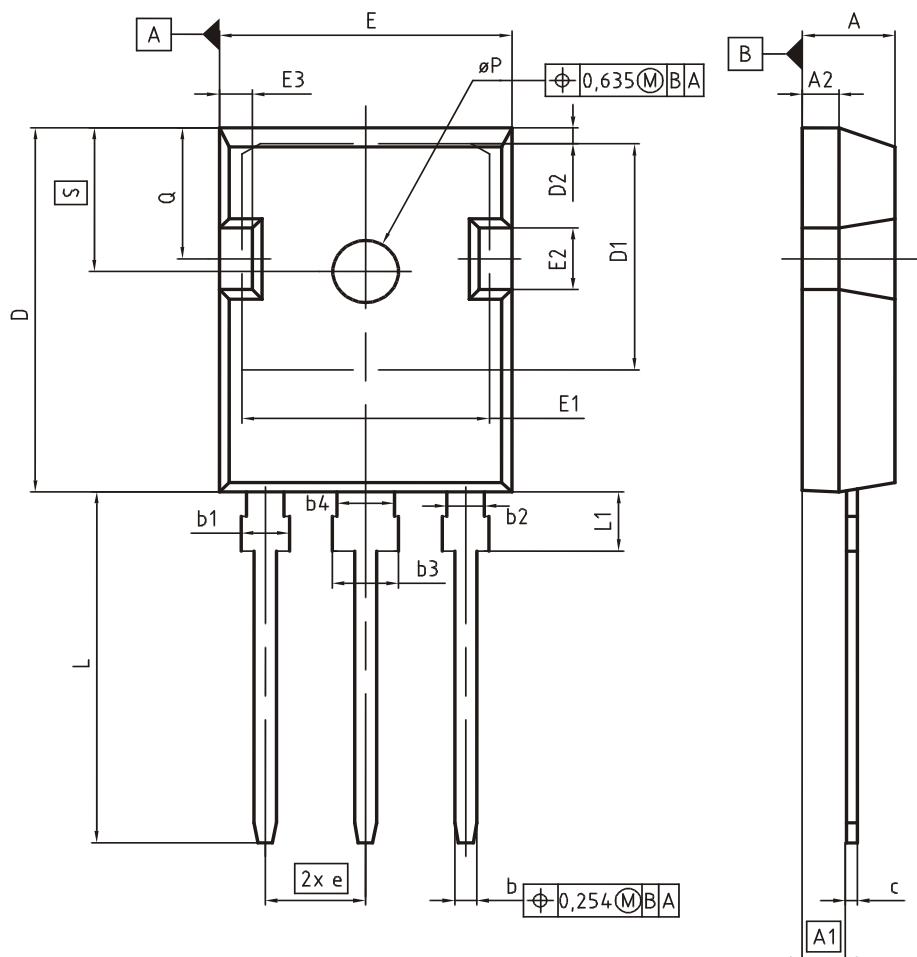
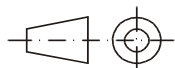


Figure 8. Typical diode forward voltage per leg as a function of junction temperature

## PG-TO247-3



| DIM | MILLIMETERS |       | INCHES      |       |
|-----|-------------|-------|-------------|-------|
|     | MIN         | MAX   | MIN         | MAX   |
| A   | 4.83        | 5.21  | 0.190       | 0.205 |
| A1  | 2.27        | 2.54  | 0.089       | 0.100 |
| A2  | 1.85        | 2.16  | 0.073       | 0.085 |
| 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   | 20.80       | 21.10 | 0.819       | 0.831 |
| D1  | 16.25       | 17.65 | 0.640       | 0.695 |
| D2  | 0.95        | 1.35  | 0.037       | 0.053 |
| E   | 15.70       | 16.13 | 0.618       | 0.635 |
| E1  | 13.10       | 14.15 | 0.516       | 0.557 |
| E2  | 3.68        | 5.10  | 0.145       | 0.201 |
| E3  | 1.00        | 2.60  | 0.039       | 0.102 |
| e   | 5.44 (BSC)  |       | 0.214 (BSC) |       |
| N   | 3           |       | 3           |       |
| L   | 19.80       | 20.32 | 0.780       | 0.800 |
| L1  | 4.10        | 4.47  | 0.161       | 0.176 |
| øP  | 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 |

|                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------|
| <b>DOCUMENT NO.</b><br>Z8B00003327                                                                                  |
| <b>SCALE</b><br>0 5 7.5mm                                                                                           |
| <b>EUROPEAN PROJECTION</b><br> |
| <b>ISSUE DATE</b><br>09-07-2010                                                                                     |
| <b>REVISION</b><br>05                                                                                               |

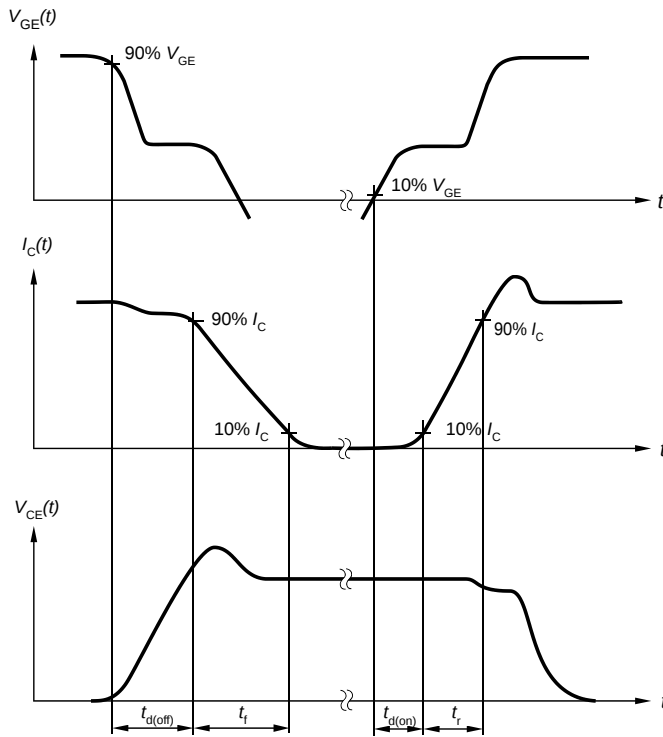


Figure A. Definition of switching times

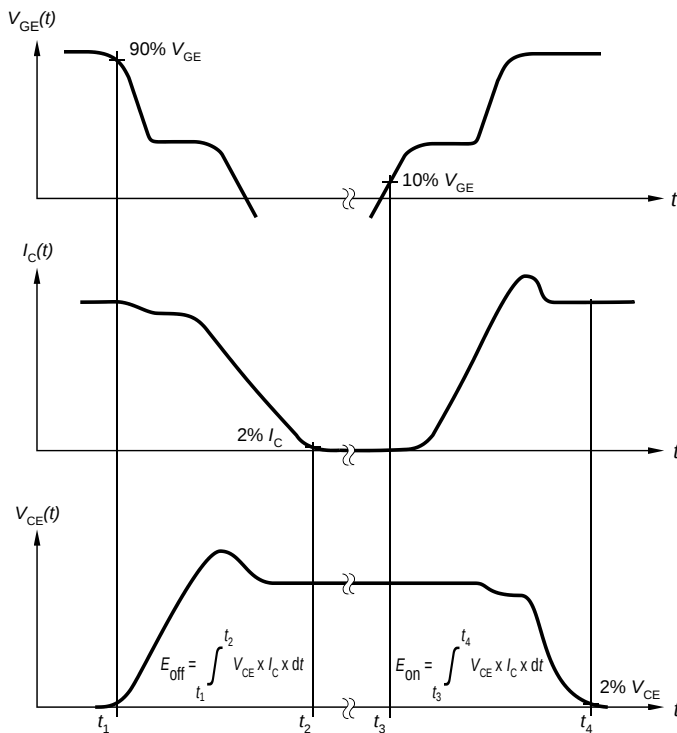


Figure B. Definition of switching losses

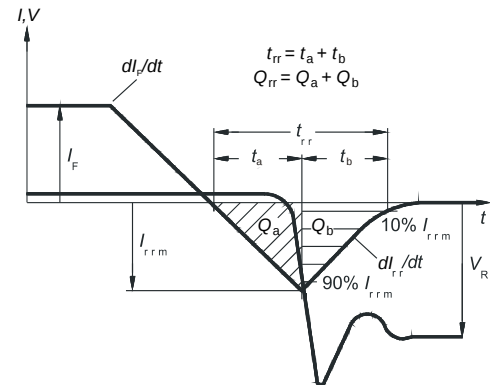


Figure C. Definition of diode switching characteristics

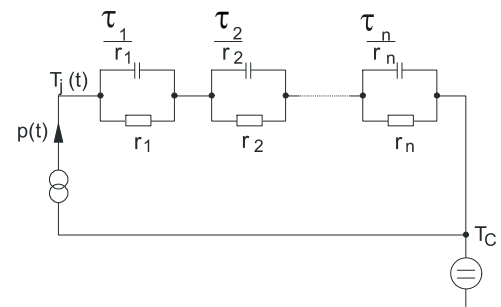
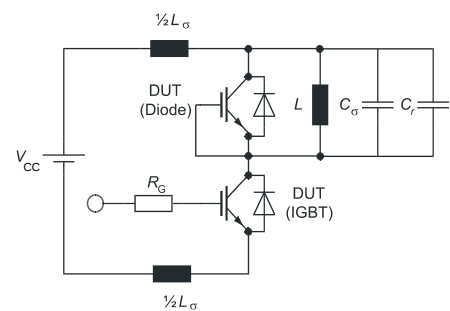


Figure D. Thermal equivalent circuit


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

## Revision History

IDW80C65D2

Revision: 2014-12-09, Rev. 2.1

### Previous Revision

| Revision | Date       | Subjects (major changes since last revision) |
|----------|------------|----------------------------------------------|
| 1.1      | 2014-12-02 | Preliminary data sheet                       |
| 2.1      | 2014-12-09 | Final data sheet                             |

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