

## Diode

Rapid Switching Emitter Controlled Diode

## IDW40E65D2

Emitter Controlled Diode

Data sheet

Industrial Power Control

## Rapid Switching Emitter Controlled Diode

### Features:

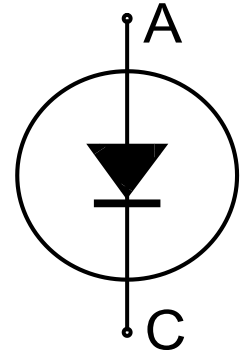
- Qualified according to JEDEC for target applications
- 650 V Emitter Controlled technology
- Fast recovery
- Soft switching
- Low reverse recovery charge
- Low forward voltage and stable over temperature
- 175 °C junction operating temperature
- Easy paralleling
- Pb-free lead plating; RoHS compliant

### Applications:

- Boost diode in CCM PFC

### Package pin definition:

- Pin 1 - not connected
- Pin 2 - cathode
- Pin 3 - anode



### Key Performance and Package Parameters

| Type       | $V_{rrm}$ | $I_f$ | $V_f, T_{vj}=25^{\circ}\text{C}$ | $T_{vjmax}$ | Marking | Package    |
|------------|-----------|-------|----------------------------------|-------------|---------|------------|
| IDW40E65D2 | 650V      | 40A   | 1.6V                             | 175°C       | E40ED2  | PG-TO247-3 |

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## Emitter Controlled Diode

### 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             |
|---------------------------------------------------------------------------------------------------------------|-------------|--------------|------------------|
| Repetitive peak reverse voltage                                                                               | $V_{RRM}$   | 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 $T_C = 25^\circ\text{C}$                                                                    | $P_{tot}$   | 180.0        | 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 1.6 mm (0.063 in.) from case for 10s                                 |             | 260          | $^\circ\text{C}$ |
| Mounting torque, M3 screw<br>Maximum of mounting processes: 3                                                 | $M$         | 0.6          | Nm               |

### Thermal Resistance

| 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 Characteristic, 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>$T_{vj} = 175^{\circ}C$ | -<br>- | 1.60<br>1.65 | 2.30<br>-      | V       |
| Reverse leakage current | $I_R$  | $V_R = 650V$<br>$T_{vj} = 25^{\circ}C$<br>$T_{vj} = 175^{\circ}C$  | -<br>- | -<br>-       | 40.0<br>4000.0 | $\mu A$ |

### 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 | $L_E$  |            | -     | 13.0 | -    | nH   |

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

**Switching Characteristic, 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>$di_F/dt = 1000\text{A}/\mu\text{s}$ | - | 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 | - | $\text{A}/\mu\text{s}$ |
| 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>$di_F/dt = 200\text{A}/\mu\text{s}$  | - | 75     | - | ns                     |
| Diode reverse recovery charge                                    | $Q_{rr}$     |                                                                                                                         | - | 0.13   | - | $\mu\text{C}$          |
| Diode peak reverse recovery current                              | $I_{rrm}$    |                                                                                                                         | - | 2.9    | - | A                      |
| Diode peak rate of fall of reverse recovery current during $t_b$ | $di_{rr}/dt$ |                                                                                                                         | - | -54    | - | $\text{A}/\mu\text{s}$ |

**Switching Characteristic, 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>$di_F/dt = 1000\text{A}/\mu\text{s}$ | - | 60    | - | ns                     |
| Diode reverse recovery charge                                    | $Q_{rr}$     |                                                                                                                          | - | 1.14  | - | $\mu\text{C}$          |
| 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>$di_F/dt = 200\text{A}/\mu\text{s}$  | - | 83    | - | ns                     |
| Diode reverse recovery charge                                    | $Q_{rr}$     |                                                                                                                          | - | 0.32  | - | $\mu\text{C}$          |
| Diode peak reverse recovery current                              | $I_{rrm}$    |                                                                                                                          | - | 5.6   | - | A                      |
| Diode peak rate of fall of reverse recovery current during $t_b$ | $di_{rr}/dt$ |                                                                                                                          | - | -51   | - | $\text{A}/\mu\text{s}$ |

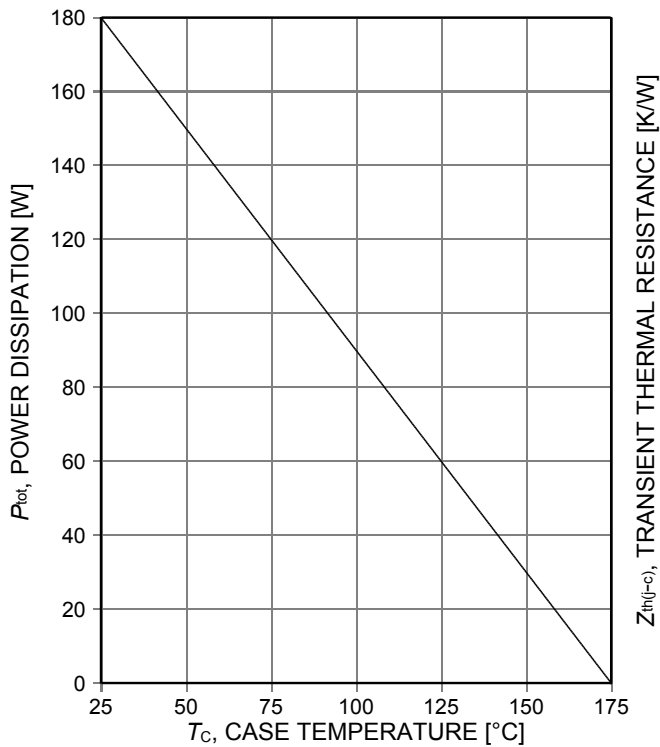


Figure 1. Power dissipation as a function of case temperature ( $T_{vj} \leq 175^\circ\text{C}$ )

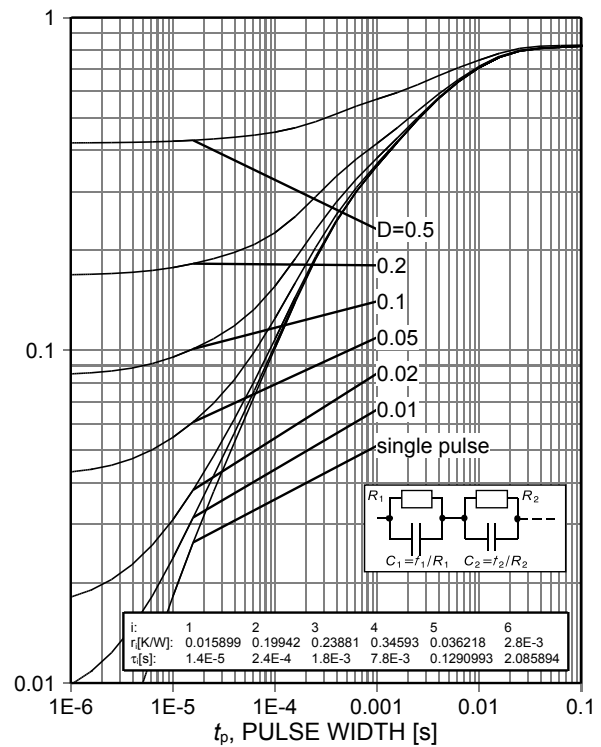


Figure 2. Diode transient thermal impedance as a function of pulse width ( $D = t_p/T$ )

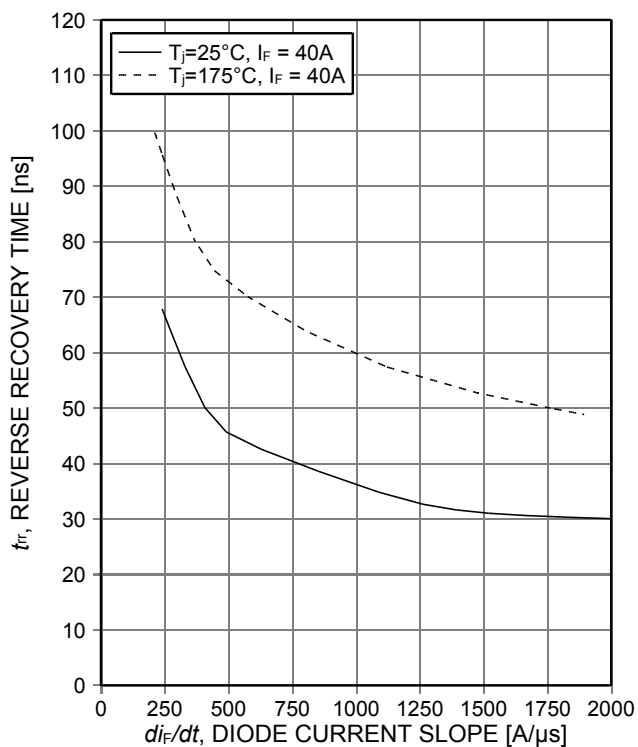


Figure 3. Typical reverse recovery time as a function of diode current slope ( $V_R = 400\text{V}$ )

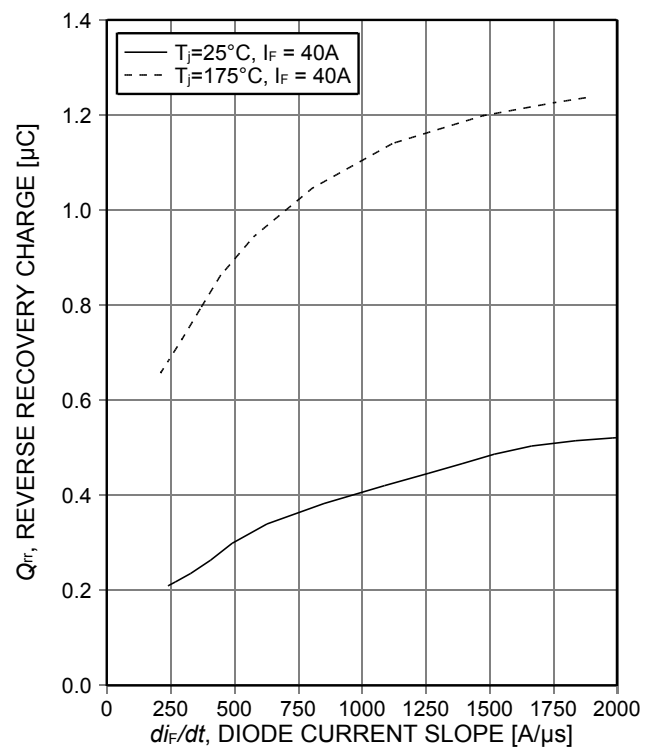


Figure 4. Typical reverse recovery charge as a function of diode current slope ( $V_R = 400\text{V}$ )

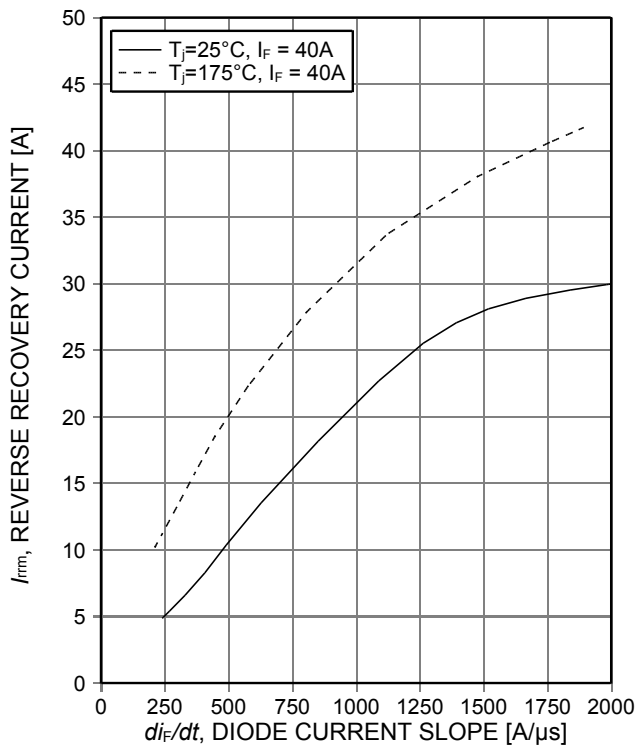


Figure 5. Typical peak reverse recovery current as a function of diode current slope ( $V_R=400V$ )

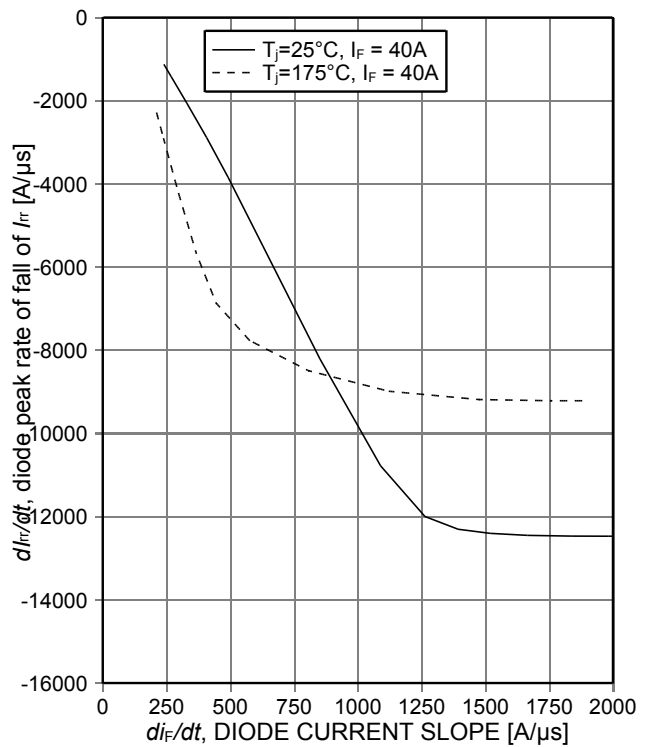


Figure 6. Typical diode peak rate of fall of reverse recovery current as a function of diode current slope ( $V_R=400V$ )

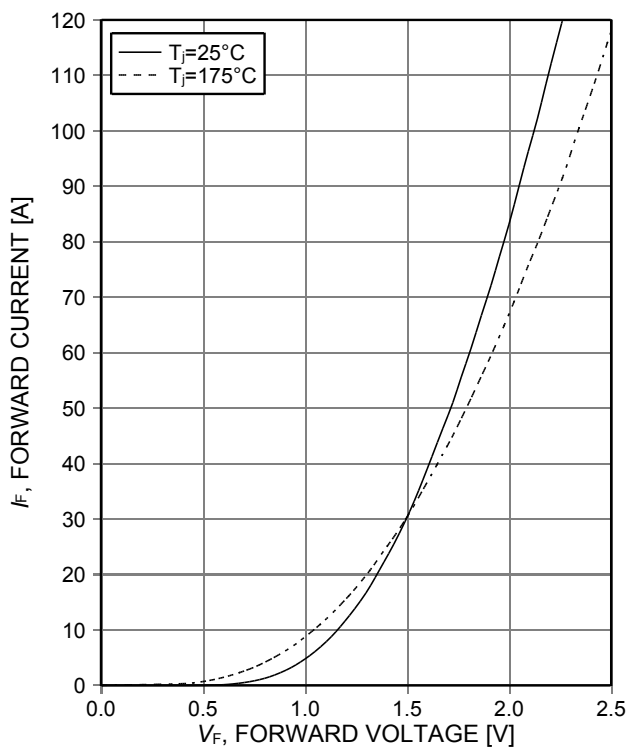


Figure 7. Typical diode forward current as a function of forward voltage

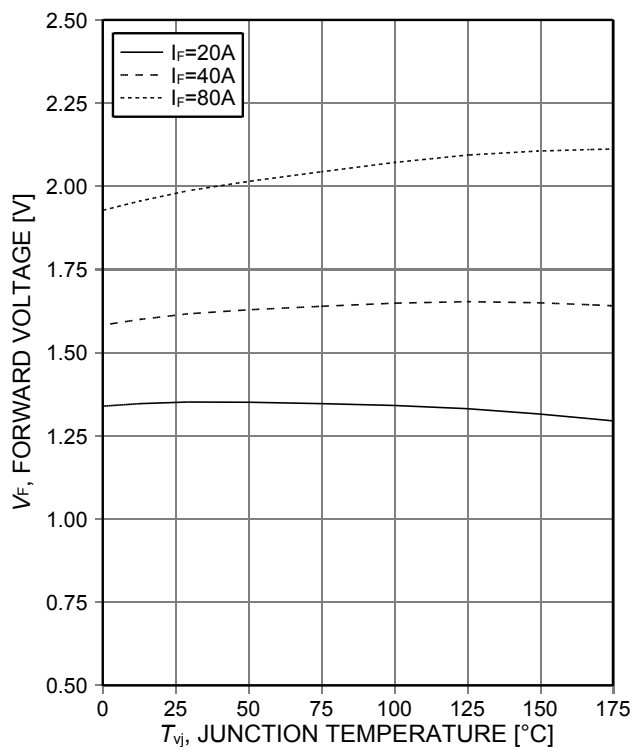
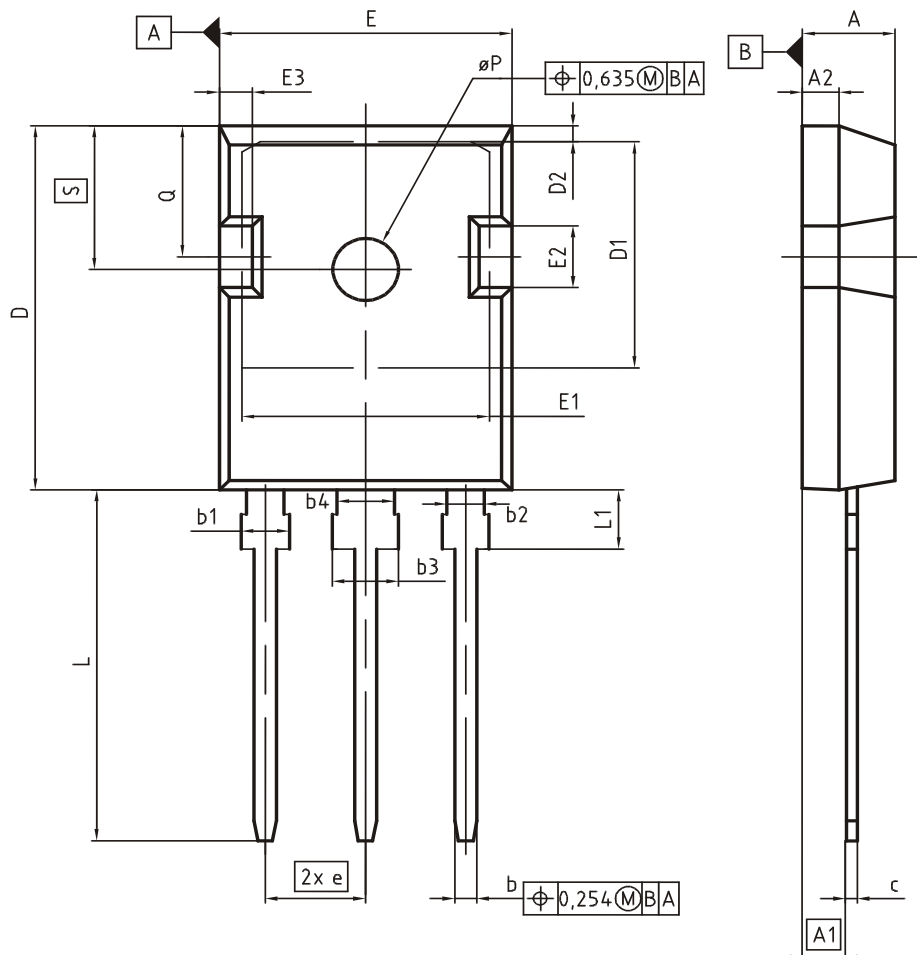
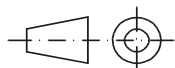


Figure 8. Typical diode forward voltage as a function of junction temperature

## 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                                                                                               |



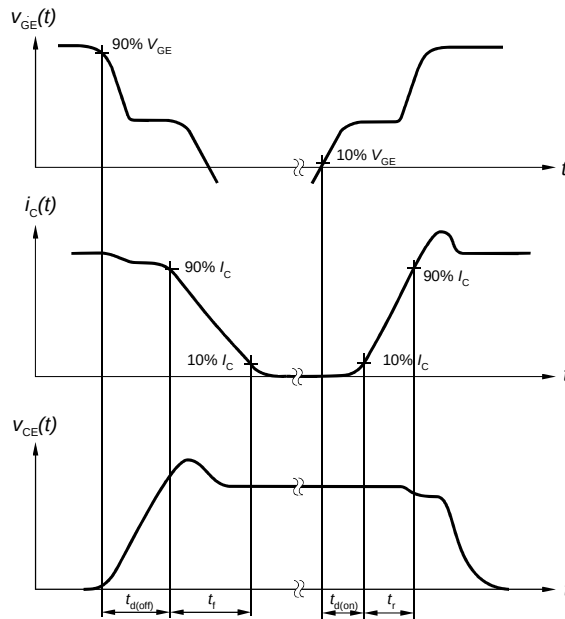


Figure A. Definition of switching times

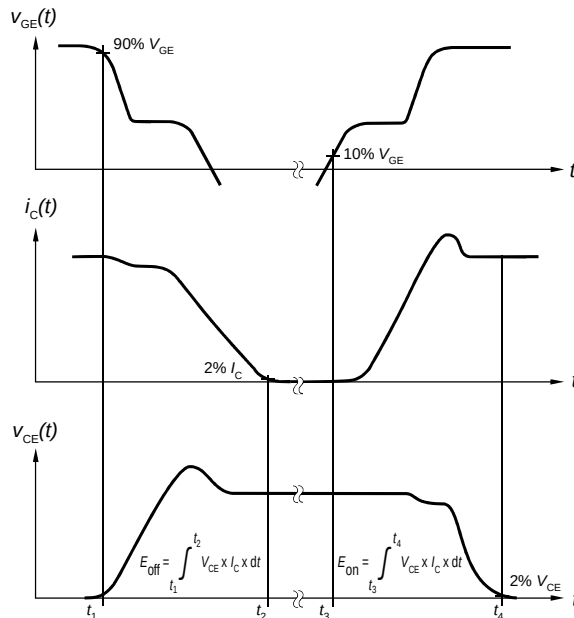


Figure B. Definition of switching losses

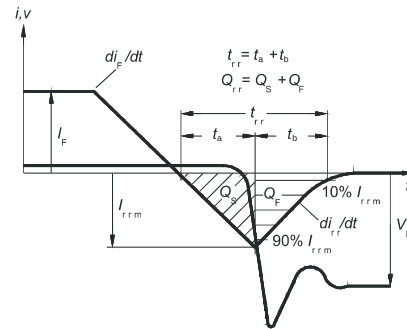


Figure C. Definition of diodes switching characteristics

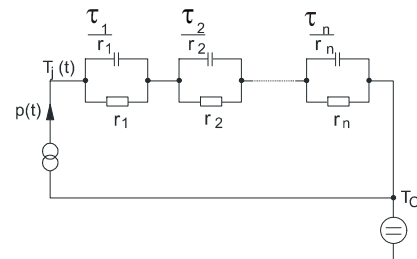
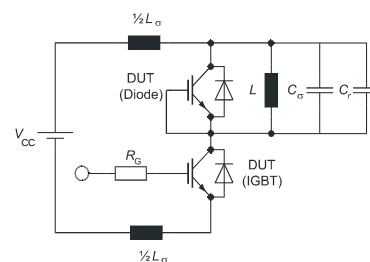


Figure D. Thermal equivalent circuit


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

## Revision History

IDW40E65D2

Revision: 2013-12-16, Rev. 2.1

## Previous Revision

| Revision | Date       | Subjects (major changes since last revision) |
|----------|------------|----------------------------------------------|
| 1.1      | 2013-03-14 | Preliminary data sheet                       |
| 1.2      | 2013-05-22 | I <sub>FSM</sub>                             |
| 2.1      | 2013-12-16 | Final DS / New Marking Pattern               |
| 2.2      | 2013-12-16 | Value VFmax limit according BE test          |

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