# Diode

Rapid Switching Emitter Controlled Diode

# IDP40E65D2

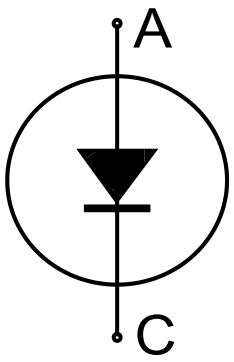
Emitter Controlled Diode

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


**Key Performance and Package Parameters**

| Type | $V_{rrm}$ | $I_f$ | $V_f$, $T_{vj}$=25°C | $T_{vjmax}$ | Marking | Package |
|---|---|---|---|---|---|---|
| IDP40E65D2 | 650V | 40A | 1.6V | 175°C | E40ED2 | PG-TO220-2-1 |

**Table of Contents**

## 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°C<br>$T_C$ = 100°C | $I_F$ | <br>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°C, $t_p$ = 8.3ms, sine halfwave | $I_{FSM}$ | <br>250.0 | A |
| Power dissipation $T_C$ = 25°C | $P_{tot}$ | 200.0 | W |
| Operating junction temperature | $T_{vj}$ | -40...+175 | °C |
| Storage temperature | $T_{stg}$ | -55...+150 | °C |
| Soldering temperature,<br>wave soldering 1.6 mm (0.063 in.) from case for 10s | | <br>260 | °C |
| Mounting torque, M3 screw<br>Maximum of mounting processes: 3 | $M$ | 0.6 | Nm |

## Thermal Resistance

| Parameter | Symbol | Conditions | Max. Value | Unit |
|---|---|---|---|---|
| **Characteristic** | | | | |
| Diode thermal resistance,[1)]<br>junction - case | $R_{th(j-c)}$ | | 0.75 | K/W |
| Thermal resistance<br>junction - ambient | $R_{th(j-a)}$ | | 62 | K/W |

## Electrical Characteristic, at $T_{vj}$ = 25°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°C<br>$T_{vj}$ = 175°C | <br>-<br>- | <br>1.60<br>1.65 | <br>2.20<br>- | V |
| Reverse leakage current | $I_R$ | $V_R$ = 650V<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 175°C | <br>-<br>- | <br>-<br>- | <br>40.0<br>4000.0 | µA |

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

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Dynamic Characteristic** | | | | | | |
| Internal emitter inductance<br>measured 5mm (0.197 in.) from case | $L_E$ | | - | 7.0 | - | nH |

[1)] Please be aware that in non standard load conditions, due to high Rth(j-c), Tvj close to Tvjmax can be reached.

**Switching Characteristic, Inductive Load**

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Diode Characteristic, at $T_{vj}$ = 25°C** | | | | | | |
| Diode reverse recovery time | $t_{rr}$ | $T_{vj}$ = 25°C, $V_R$ = 400V, $I_F$ = 40.0A, $di_F/dt$ = 1000A/µs | - | 36 | - | ns |
| Diode reverse recovery charge | $Q_{rr}$ | | - | 0.40 | - | µC |
| 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/µs |
| Diode reverse recovery time | $t_{rr}$ | $T_{vj}$ = 25°C, $V_R$ = 400V, $I_F$ = 40.0A, $di_F/dt$ = 200A/µs | - | 75 | - | ns |
| Diode reverse recovery charge | $Q_{rr}$ | | - | 0.13 | - | µC |
| 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 | - | A/µs |

**Switching Characteristic, Inductive Load**

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **Diode Characteristic, at $T_{vj}$ = 175°C/125°C** | | | | | | |
| Diode reverse recovery time | $t_{rr}$ | $T_{vj}$ = 175°C, $V_R$ = 400V, $I_F$ = 40.0A, $di_F/dt$ = 1000A/µs | - | 60 | - | ns |
| Diode reverse recovery charge | $Q_{rr}$ | | - | 1.14 | - | µC |
| 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 | - | A/µs |
| Diode reverse recovery time | $t_{rr}$ | $T_{vj}$ = 125°C, $V_R$ = 400V, $I_F$ = 40.0A, $di_F/dt$ = 200A/µs | - | 83 | - | ns |
| Diode reverse recovery charge | $Q_{rr}$ | | - | 0.32 | - | µC |
| 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 | - | A/µs |

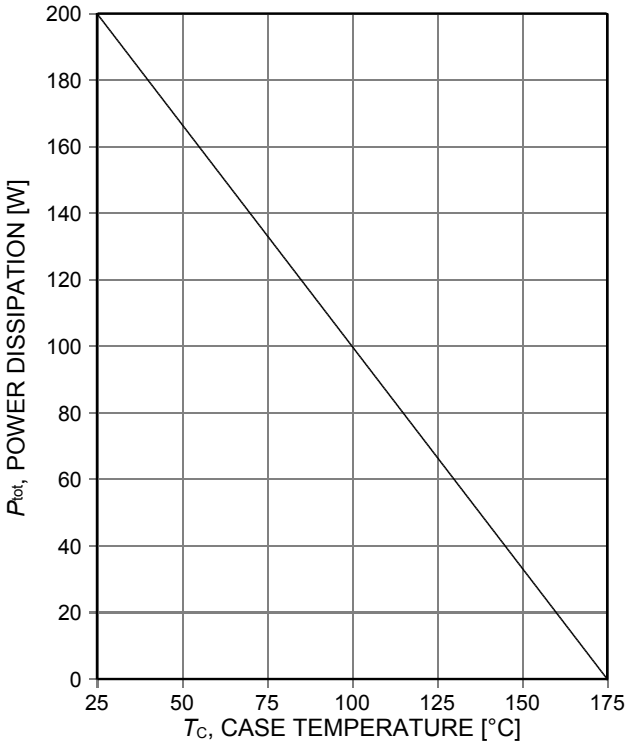



Figure 1. **Power dissipation as a function of case temperature**
($T_{vj}$≤175°C)

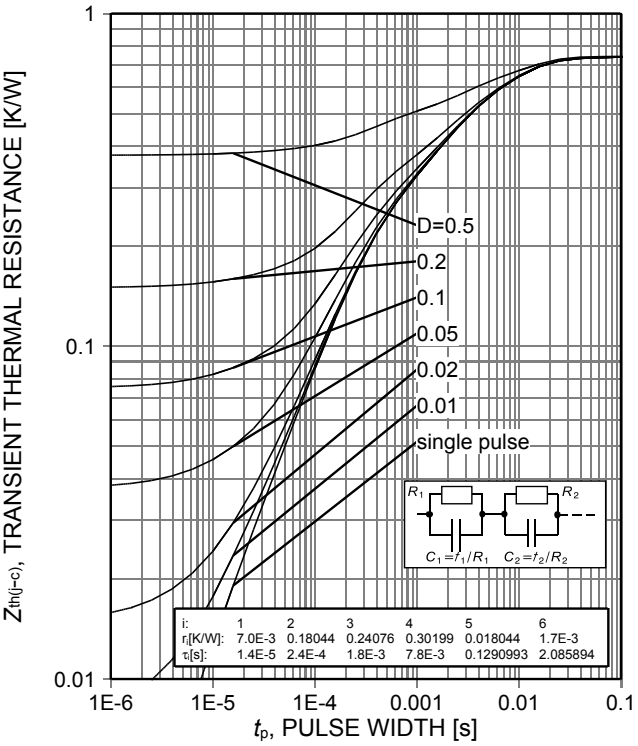



Figure 2. **Diode transient thermal impedance as a function of pulse width**
($D$=$t_p$/T)

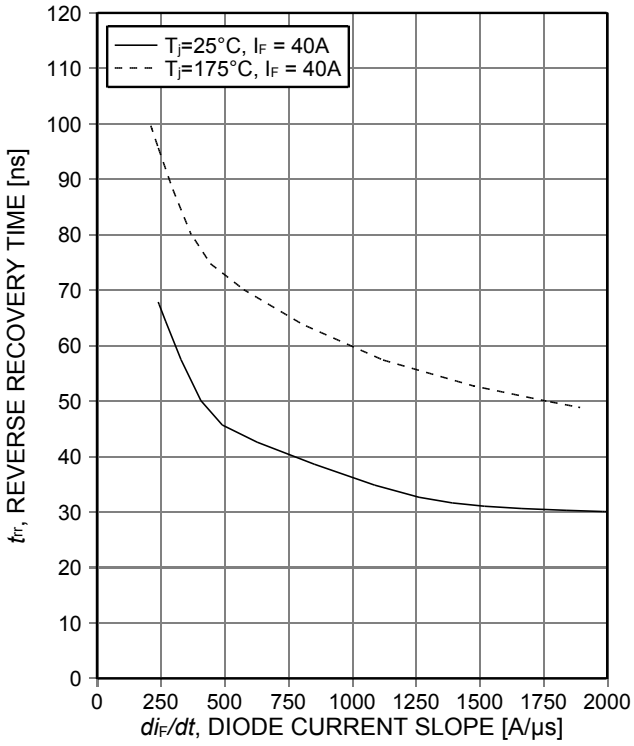



Figure 3. **Typical reverse recovery time as a function of diode current slope**
($V_R$=400V)

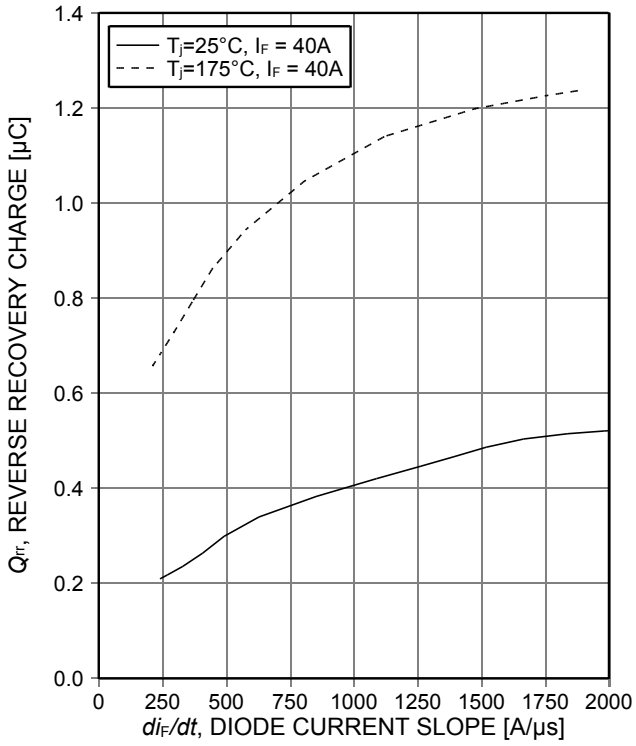



Figure 4. **Typical reverse recovery charge as a function of diode current slope**
($V_R$=400V)

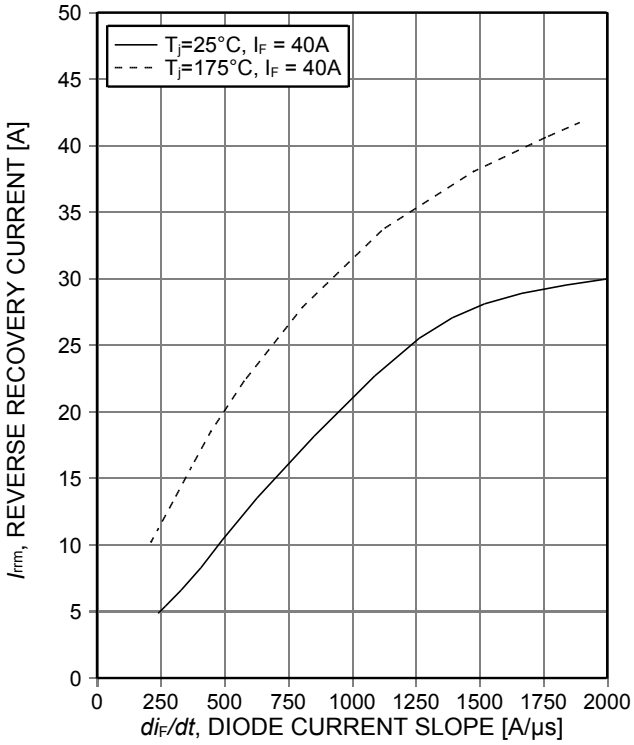



Figure 5. **Typical peak reverse recovery current as a function of diode current slope**
($V_R$=400V)

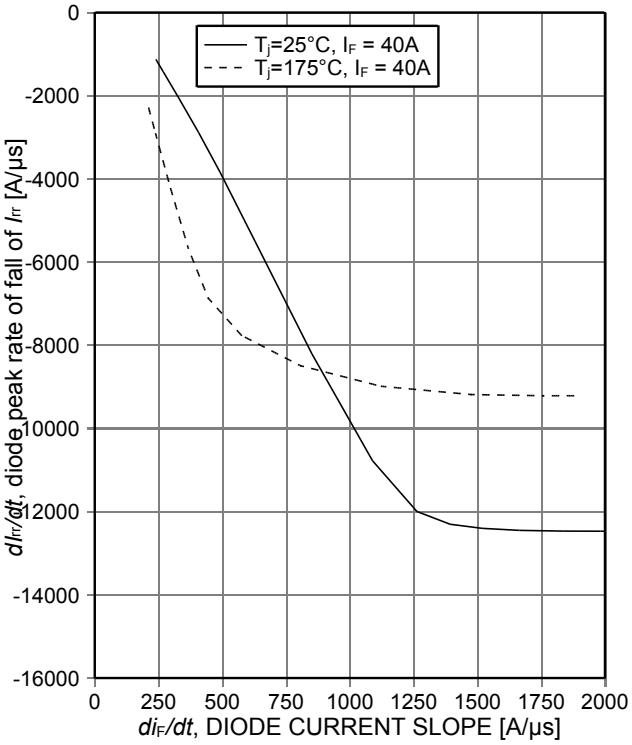



Figure 6. **Typical diode peak rate of fall of reverse recovery current as a function of diode current slope**
($V_R$=400V)

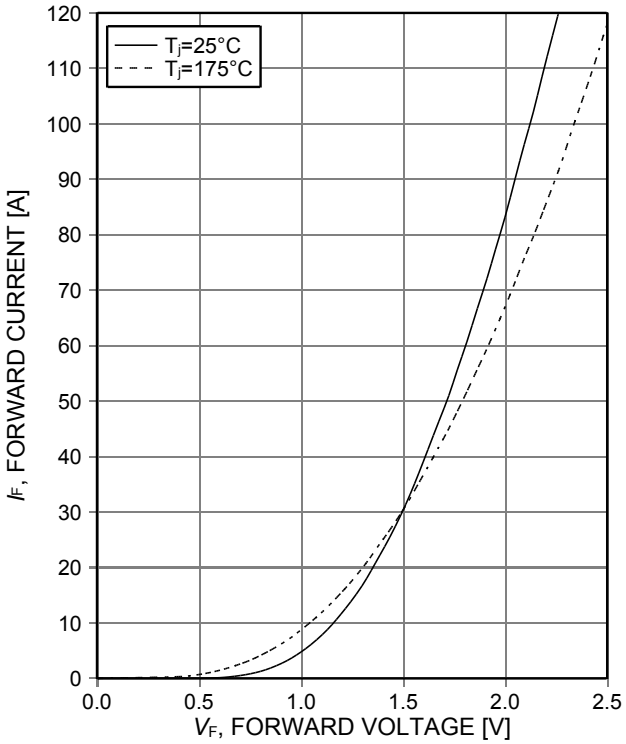



Figure 7. **Typical diode forward current as a function of forward voltage**

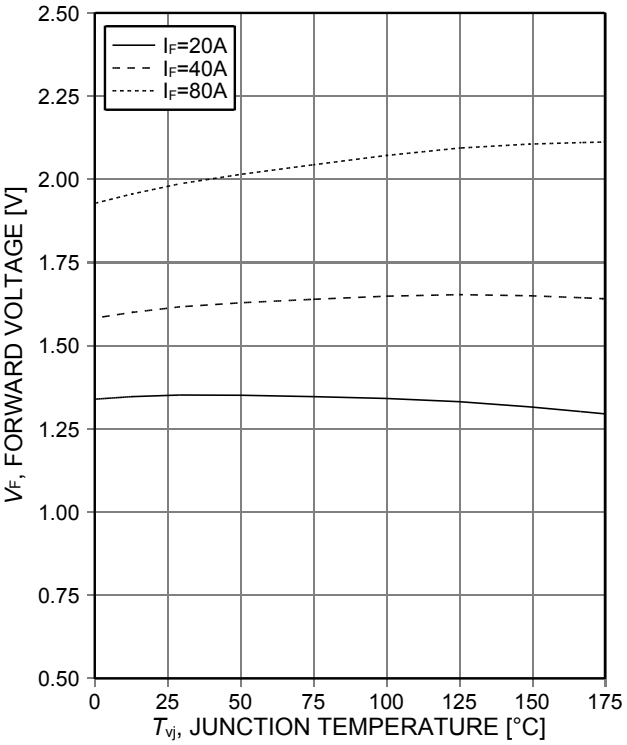
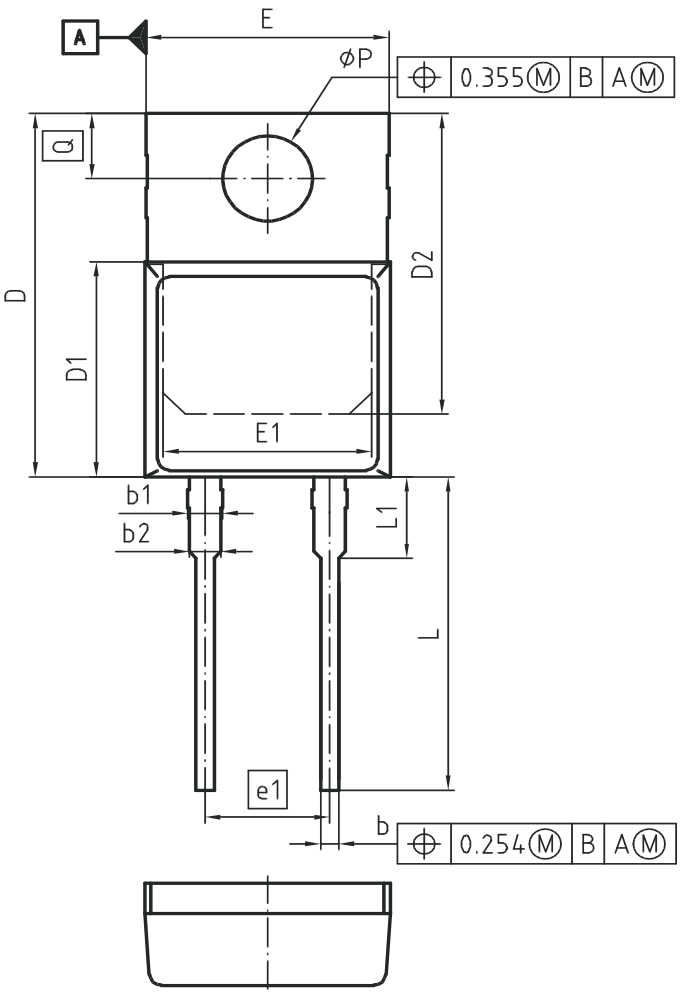



Figure 8. **Typical diode forward voltage as a function of junction temperature**

# PG-TO220-2-1




| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 4.30 | 4.50 | 0.169 | 0.177 |
| A1 | 1.17 | 1.37 | 0.046 | 0.054 |
| A2 | 2.30 | 2.50 | 0.091 | 0.098 |
| b | 0.65 | 0.85 | 0.026 | 0.033 |
| b1 | 1.19 | 1.69 | 0.047 | 0.066 |
| b2 | 1.19 | 1.39 | 0.047 | 0.055 |
| c | 0.40 | 0.60 | 0.016 | 0.024 |
| D | 15.35 | 15.95 | 0.604 | 0.628 |
| D1 | 9.05 | 9.45 | 0.356 | 0.372 |
| D2 | 12.30 | 13.05 | 0.484 | 0.514 |
| E | 9.80 | 10.20 | 0.386 | 0.402 |
| E1 | 7.25 | 8.60 | 0.285 | 0.339 |
| e1 | 5.08 | | 0.200 | |
| N | 2 | | 2 | |
| H1 | 5.90 | 6.90 | 0.232 | 0.272 |
| L | 13.00 | 14.00 | 0.512 | 0.551 |
| L1 | 3.30 | 3.70 | 0.130 | 0.146 |
| øP | 3.55 | 3.70 | 0.140 | 0.146 |
| Q | 2.60 | 3.00 | 0.102 | 0.118 |

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SCALE 0 2.5 0 2.5 5mm

EUROPEAN PROJECTION

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28-10-2008

REVISION
01

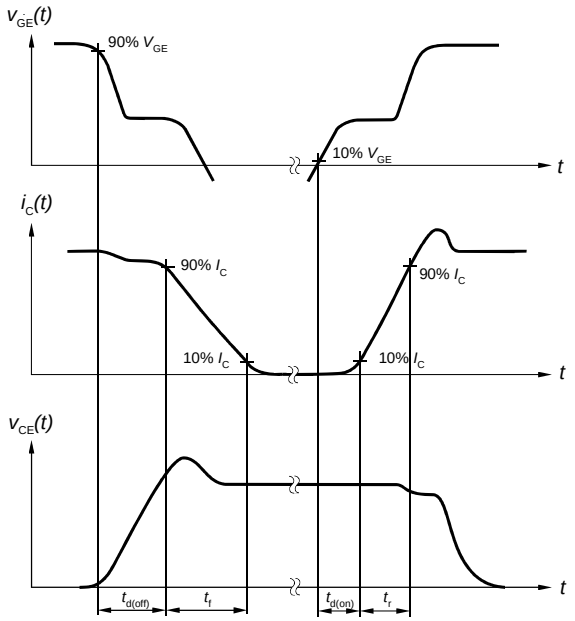


**Figure A. Definition of switching times**

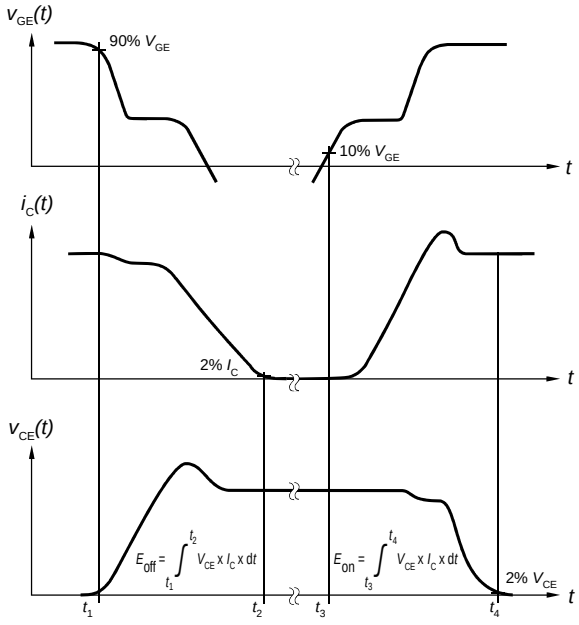


**Figure B. Definition of switching losses**

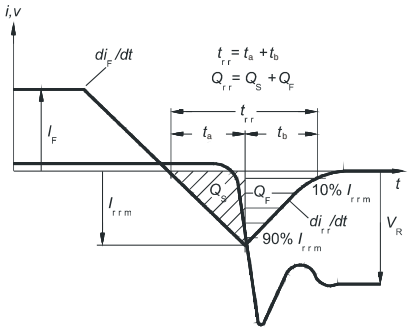


**Figure C. Definition of diodes switching characteristics**

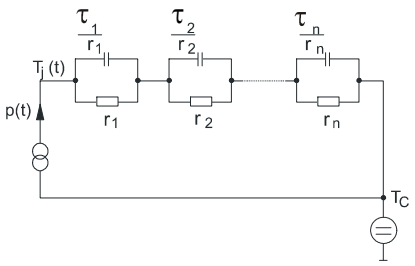


**Figure D. Thermal equivalent circuit**

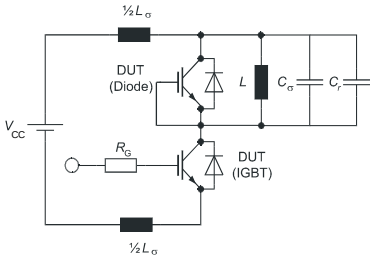


**Figure E. Dynamic test circuit**
Parasitic inductance $L_\sigma$,
Parasitic capacitor $C_\sigma$,
Relief capacitor $C_r$,
(only for ZVT switching)

Revision History

IDP40E65D2

Revision: 2014-03-31, Rev. 2.2

Previous Revision

| Revision | Date | Subjects (major changes since last revision) |
|---|---|---|
| 1.1 | 2013-03-14 | Preliminary data sheet |
| 1.2 | 2013-03-14 | - |
| 2.1 | 2013-12-16 | Final DS / New Marking Pattern |
| 2.2 | 2014-03-31 | Value VFmax limit according BE test |

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