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Diode

Rapid Switching Emitter Controlled Diode

IDW40E65D2

Emitter Controlled Diode

Data sheet

Industrial Power Control

Rapid Switching Emitter Controlled Diode

Features:

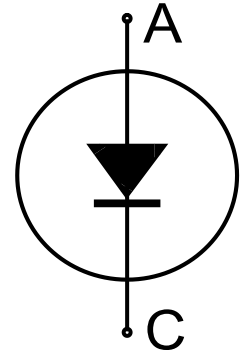
- Qualified according to JEDEC for target applications
- 650 V Emitter Controlled technology
- Fast recovery
- Soft switching
- Low reverse recovery charge
- Low forward voltage and stable over temperature
- 175 °C junction operating temperature
- Easy paralleling
- Pb-free lead plating; RoHS compliant

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} $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$ | I_F | 80.0 40.0 | A |
| Diode pulsed current, t_p limited by T_{vjmax} | I_{Fpuls} | 120.0 | A |
| Diode surge non repetitive forward current $T_C = 25^\circ\text{C}$, $t_p = 8.3\text{ms}$, 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, wave soldering 1.6 mm (0.063 in.) from case for 10s | | 260 | $^\circ\text{C}$ |
| Mounting torque, M3 screw Maximum of mounting processes: 3 | M | 0.6 | Nm |

Thermal Resistance

| Parameter | Symbol | Conditions | Max. Value | Unit |
|--|---------------|------------|------------|------|
| Characteristic | | | | |
| Diode thermal resistance, ¹⁾ junction - case | $R_{th(j-c)}$ | | 0.84 | K/W |
| Thermal resistance 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 | $I_F = 40.0\text{A}$ $T_{vj} = 25^\circ\text{C}$ $T_{vj} = 175^\circ\text{C}$ | - - | 1.60 1.65 | 2.30 - | V |
| Reverse leakage current | I_R | $V_R = 650\text{V}$ $T_{vj} = 25^\circ\text{C}$ $T_{vj} = 175^\circ\text{C}$ | - - | - - | 40.0 4000.0 | μA |

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 measured 5mm (0.197 in.) from case | L_E | | - | 13.0 | - | nH |

¹⁾ 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.

Emitter Controlled Diode

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} | $T_{vj} = 25^{\circ}\text{C}$, $V_R = 400\text{V}$, $I_F = 40.0\text{A}$, $di_F/dt = 1000\text{A}/\mu\text{s}$ | - | 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 | - | $\text{A}/\mu\text{s}$ |
| Diode reverse recovery time | t_{rr} | $T_{vj} = 25^{\circ}\text{C}$, $V_R = 400\text{V}$, $I_F = 40.0\text{A}$, $di_F/dt = 200\text{A}/\mu\text{s}$ | - | 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 | - | $\text{A}/\mu\text{s}$ |

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} | $T_{vj} = 175^{\circ}\text{C}$, $V_R = 400\text{V}$, $I_F = 40.0\text{A}$, $di_F/dt = 1000\text{A}/\mu\text{s}$ | - | 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 | - | $\text{A}/\mu\text{s}$ |
| Diode reverse recovery time | t_{rr} | $T_{vj} = 125^{\circ}\text{C}$, $V_R = 400\text{V}$, $I_F = 40.0\text{A}$, $di_F/dt = 200\text{A}/\mu\text{s}$ | - | 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 | - | $\text{A}/\mu\text{s}$ |

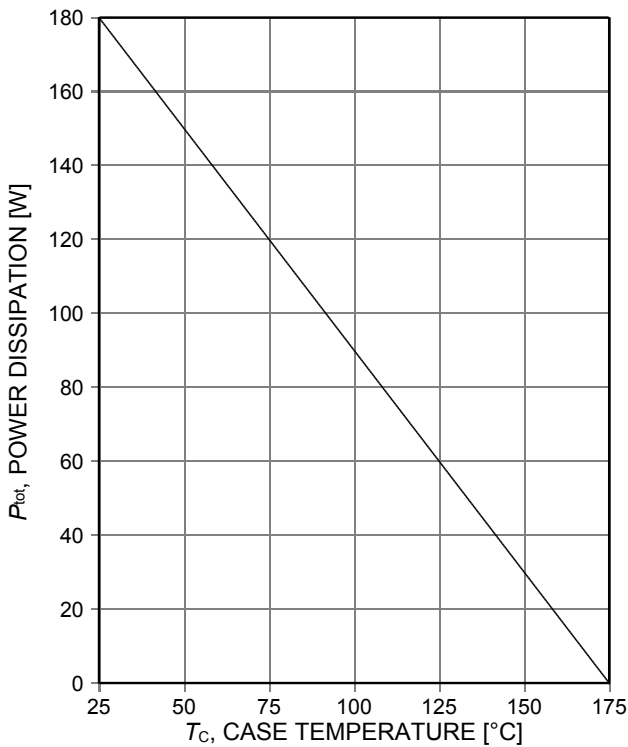


Figure 1. Power dissipation as a function of case temperature ($T_{vj} \leq 175^\circ\text{C}$)

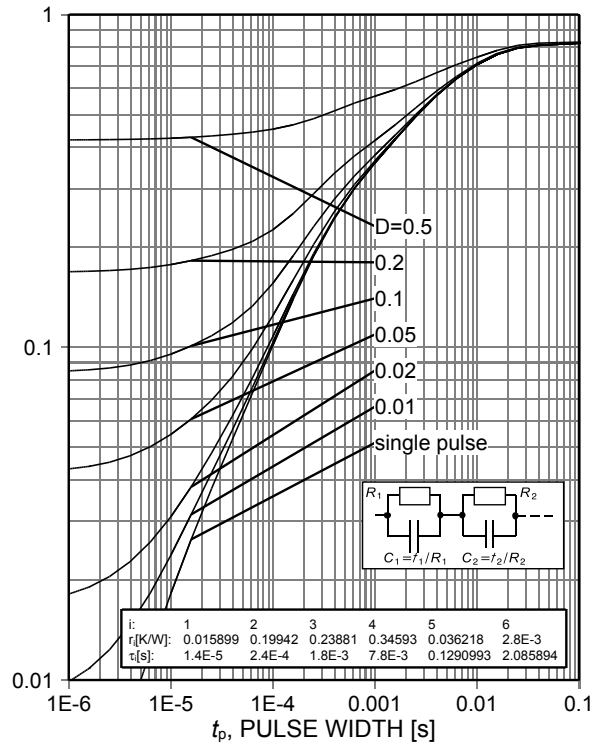


Figure 2. Diode transient thermal impedance as a function of pulse width ($D = t_p/T$)

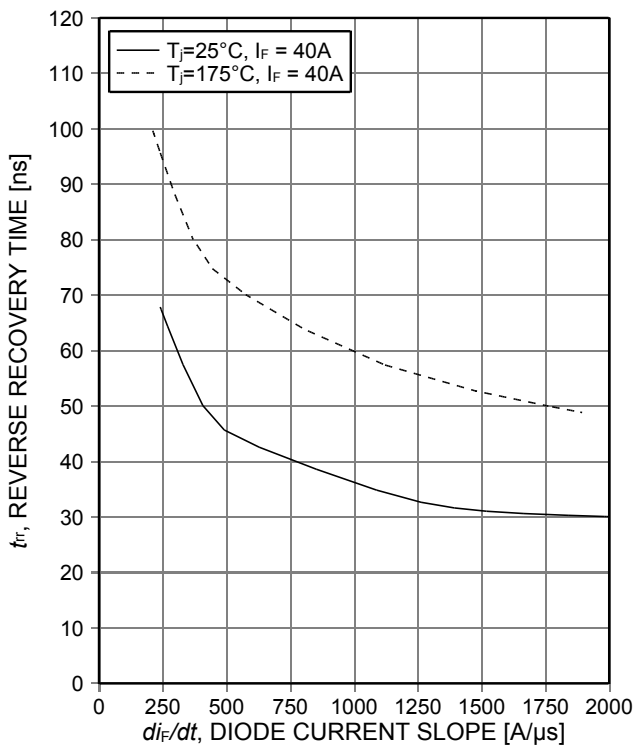


Figure 3. Typical reverse recovery time as a function of diode current slope ($V_R=400\text{V}$)

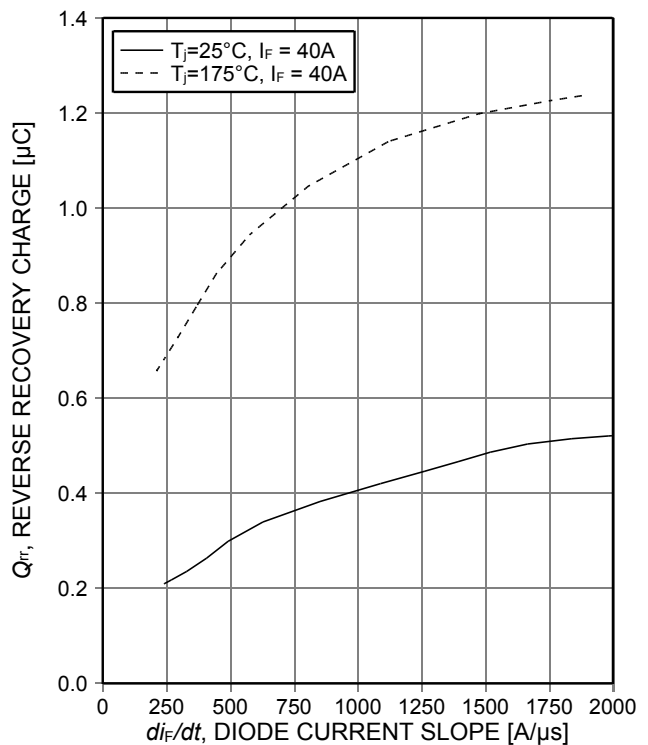


Figure 4. Typical reverse recovery charge as a function of diode current slope ($V_R=400\text{V}$)

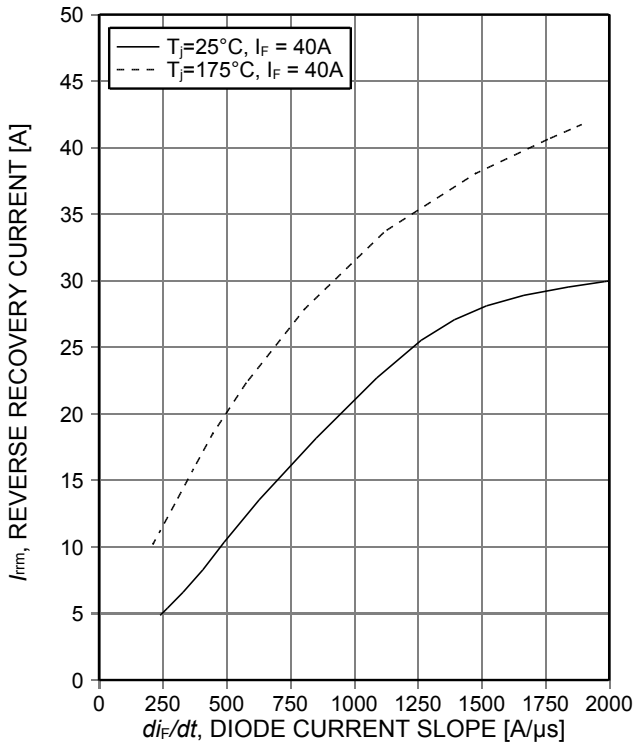


Figure 5. Typical peak reverse recovery current as a function of diode current slope ($V_R=400V$)

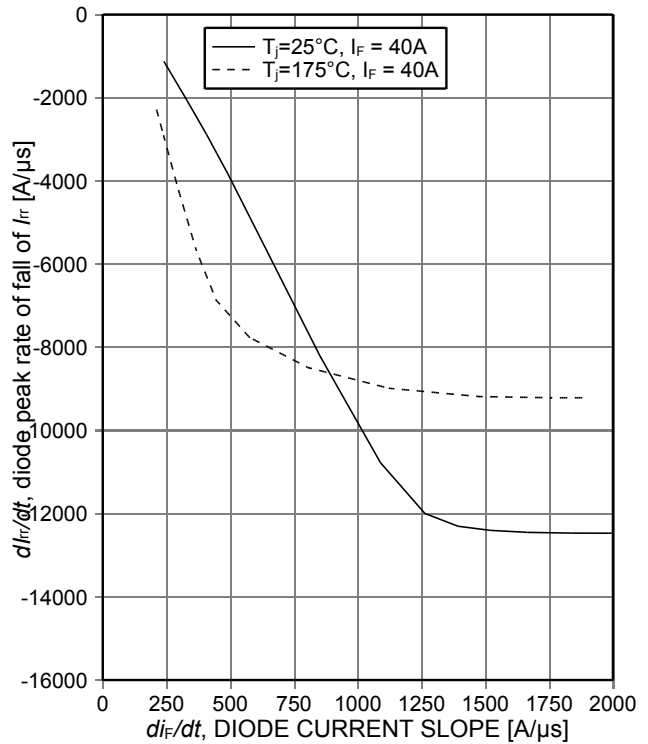


Figure 6. Typical diode peak rate of fall of reverse recovery current as a function of diode current slope ($V_R=400V$)

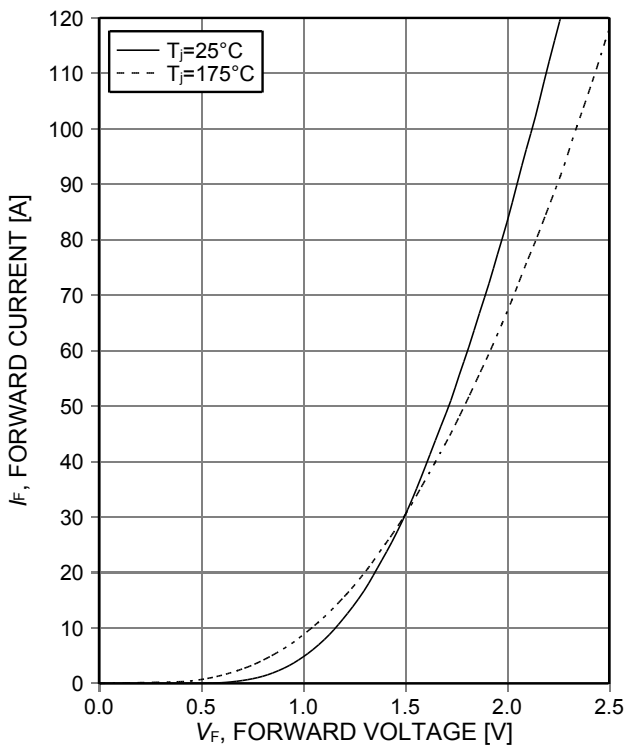


Figure 7. Typical diode forward current as a function of forward voltage

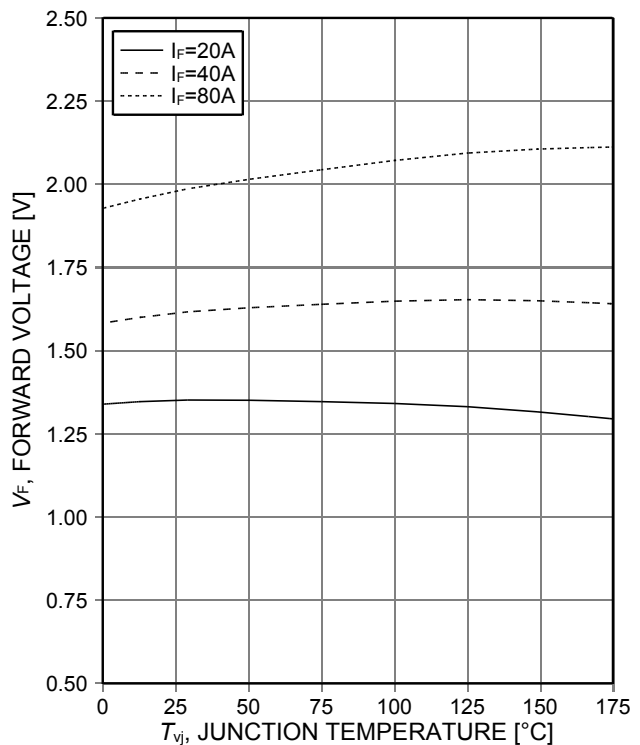
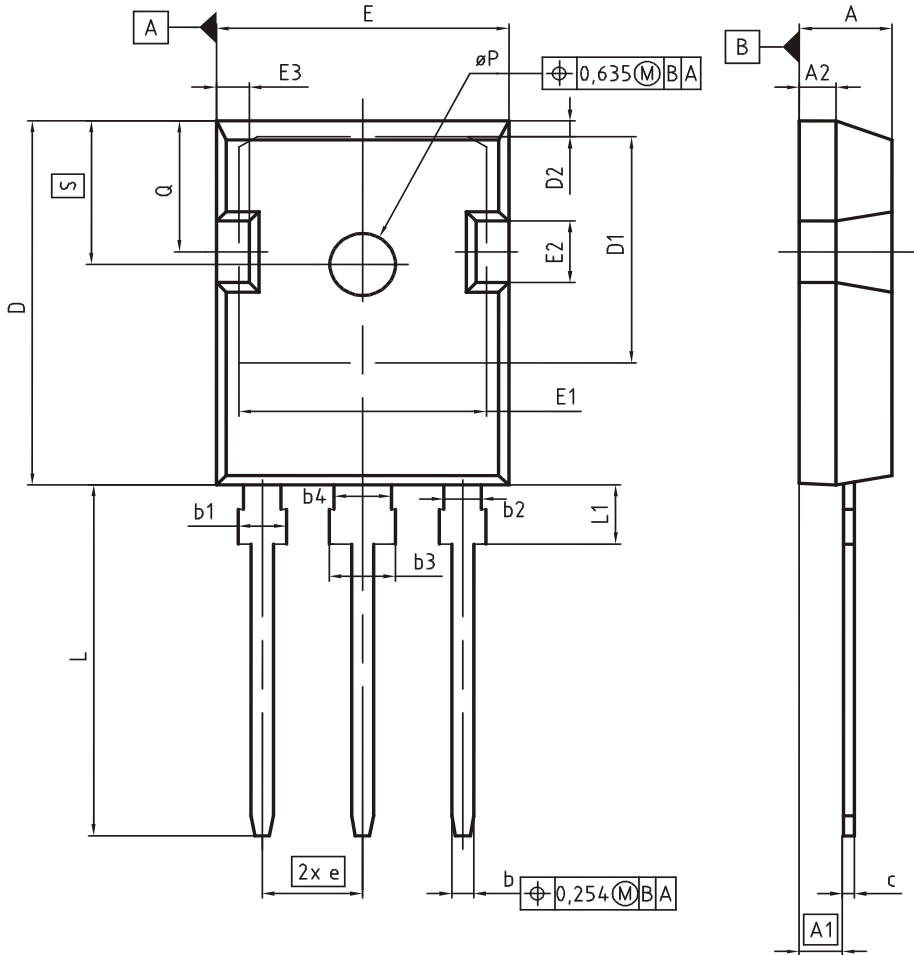


Figure 8. Typical diode forward voltage as a function of junction temperature

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 |

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05

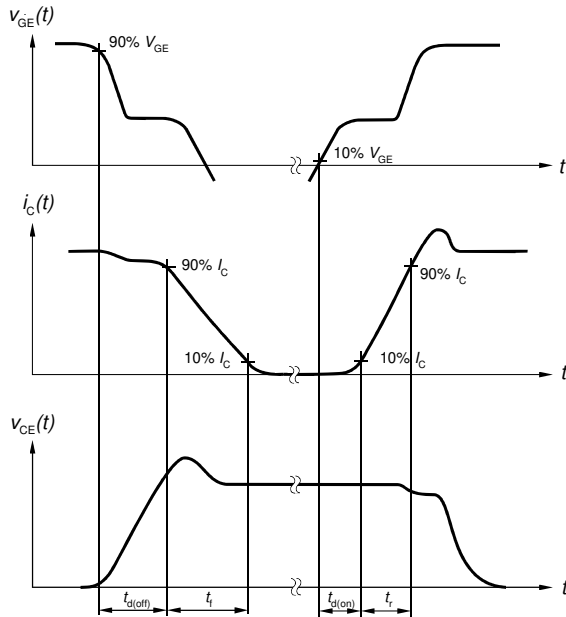


Figure A. Definition of switching times

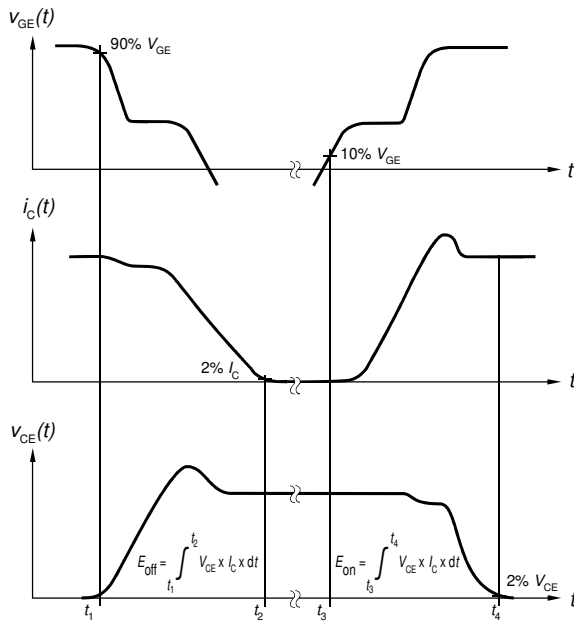


Figure B. Definition of switching losses

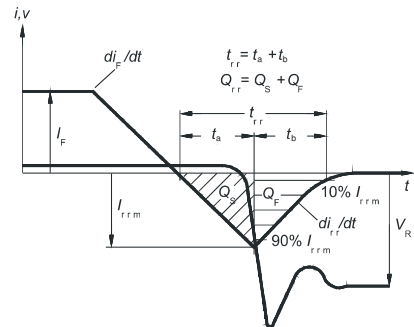


Figure C. Definition of diodes switching characteristics

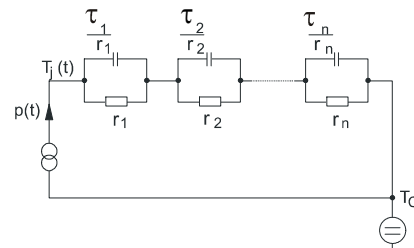


Figure D. Thermal equivalent circuit

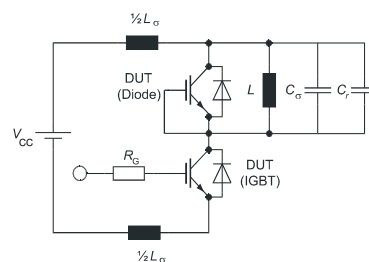


Figure E. Dynamic test circuit
Parasitic inductance L_σ ,
Parasitic capacitor C_σ ,
Relief capacitor C_r
(only for ZVT switching)

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 _{FSM} |
| 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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