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## Diode

Rapid Switching Emitter Controlled Diode

## IDW40E65D1

Emitter Controlled Diode Rapid 1 Series

Data sheet



IDW40E65D1

Emitter Controlled Diode Rapid 1 Series

## Rapid Switching Emitter Controlled Diode

### Features:

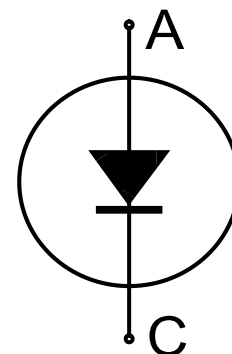
- 650 V Emitter Controlled technology
- Temperature stable behaviour of key parameters
- Low forward voltage ( $V_F$ )
- Ultra fast recovery
- Low reverse recovery charge ( $Q_{rr}$ )
- Low reverse recovery current ( $I_{rrm}$ )
- Softness factor  $>1$
- 175 °C junction operating temperature
- Pb-free lead plating; RoHS compliant

### Applications:

- AC/DC converters
- Boost diode in PFC stages
- Free wheeling diodes in inverters and motor drives
- General purpose inverters
- Switch mode power supplies

### Package pin definition:

- Pin 1 - not connected
- Pin 2 and backside - 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
IDW40E65D1	650V	40A	1.35V	175°C	E40ED1	PG-TO247-3



# IDW40E65D1

## Emitter Controlled Diode Rapid 1 Series

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**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 $T_C = 25^\circ\text{C}$ , $t_p = 10.0\text{ms}$ , sine halfwave	$I_{FSM}$	320.0	A
Power dissipation $T_C = 25^\circ\text{C}$	$P_{tot}$	179.0	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
<b>Characteristic</b>				
Diode thermal resistance, <sup>1)</sup> 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.	
<b>Static Characteristic</b>						
Diode forward voltage	$V_F$	$I_F = 40.0\text{A}$ $T_{vj} = 25^\circ\text{C}$ $T_{vj} = 125^\circ\text{C}$ $T_{vj} = 175^\circ\text{C}$	- - -	1.35 1.32 1.28	1.70 - -	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	$\mu\text{A}$

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

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>Dynamic Characteristic</b>						
Internal emitter inductance measured 5mm (0.197 in.) from case	$L_E$		-	13.0	-	nH



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## Emitter Controlled Diode Rapid 1 Series

### 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	$t_{rr}$	$T_{vj} = 25^{\circ}\text{C},$ $V_R = 400\text{V},$ $I_F = 40.0\text{A},$ $di_F/dt = 1000\text{A}/\mu\text{s}$	-	77	-	ns
Diode reverse recovery charge	$Q_{rr}$		-	0.87	-	$\mu\text{C}$
Diode peak reverse recovery current	$I_{rrm}$		-	17.5	-	A
Diode peak rate of fall of reverse recovery current during $t_b$	$di_{rr}/dt$		-	-1520	-	$\text{A}/\mu\text{s}$
Diode reverse recovery time	$t_{rr}$	$T_{vj} = 25^{\circ}\text{C},$ $V_R = 400\text{V},$ $I_F = 40.0\text{A},$ $di_F/dt = 200\text{A}/\mu\text{s}$	-	129	-	ns
Diode reverse recovery charge	$Q_{rr}$		-	0.49	-	$\mu\text{C}$
Diode peak reverse recovery current	$I_{rrm}$		-	6.9	-	A
Diode peak rate of fall of reverse recovery current during $t_b$	$di_{rr}/dt$		-	-300	-	$\text{A}/\mu\text{s}$

### 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	$t_{rr}$	$T_{vj} = 175^{\circ}\text{C},$ $V_R = 400\text{V},$ $I_F = 40.0\text{A},$ $di_F/dt = 1000\text{A}/\mu\text{s}$	-	110	-	ns
Diode reverse recovery charge	$Q_{rr}$		-	2.36	-	$\mu\text{C}$
Diode peak reverse recovery current	$I_{rrm}$		-	27.3	-	A
Diode peak rate of fall of reverse recovery current during $t_b$	$di_{rr}/dt$		-	-1320	-	$\text{A}/\mu\text{s}$
Diode reverse recovery time	$t_{rr}$	$T_{vj} = 125^{\circ}\text{C},$ $V_R = 400\text{V},$ $I_F = 40.0\text{A},$ $di_F/dt = 200\text{A}/\mu\text{s}$	-	163	-	ns
Diode reverse recovery charge	$Q_{rr}$		-	1.04	-	$\mu\text{C}$
Diode peak reverse recovery current	$I_{rrm}$		-	10.4	-	A
Diode peak rate of fall of reverse recovery current during $t_b$	$di_{rr}/dt$		-	-600	-	$\text{A}/\mu\text{s}$



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Emitter Controlled Diode Rapid 1 Series

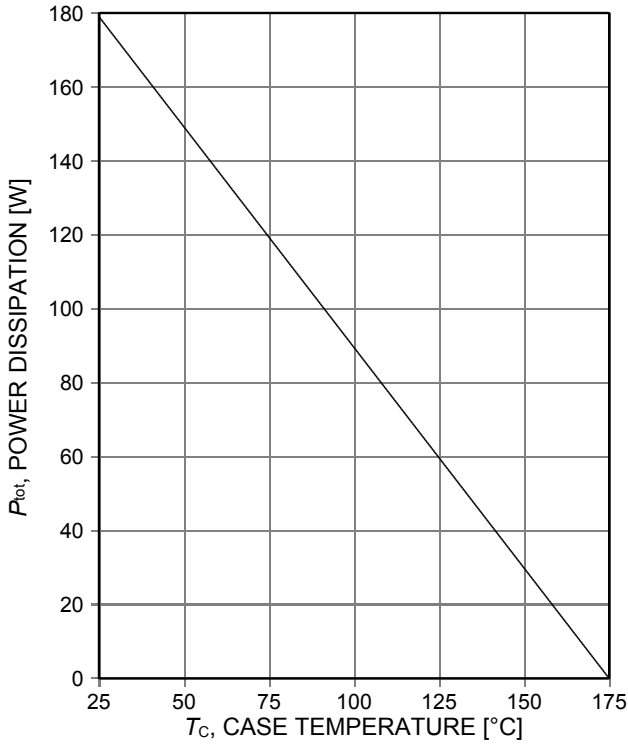


Figure 1. Power dissipation as a function of case temperature ( $T_{vj} \leq 175^\circ\text{C}$ )

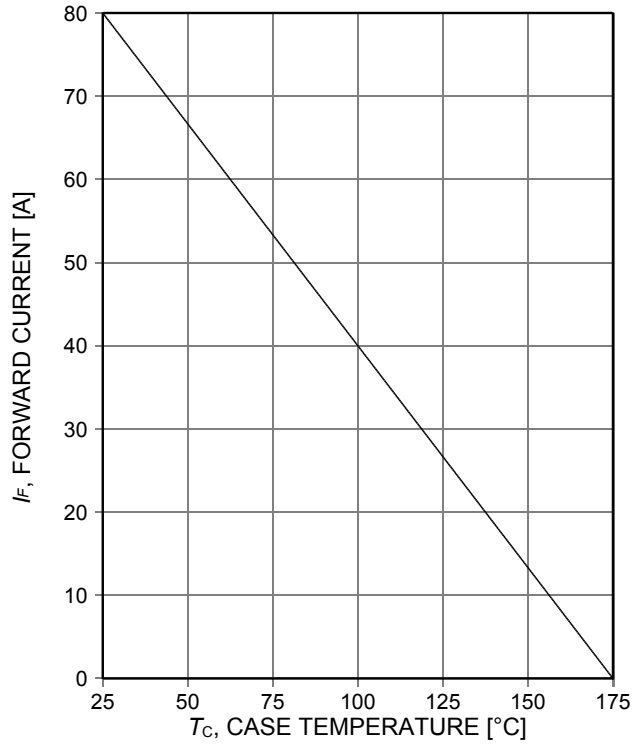


Figure 2. Diode forward current as a function of case temperature ( $T_{vj} \leq 175^\circ\text{C}$ )

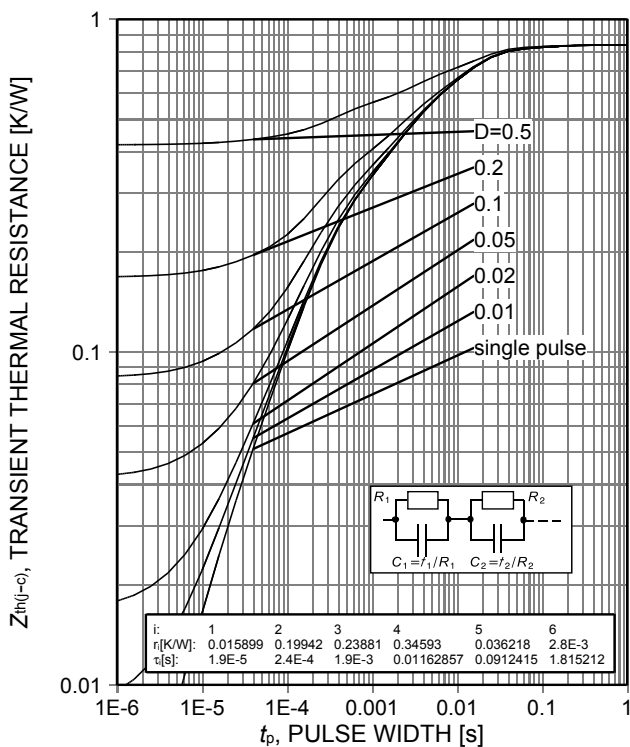


Figure 3. Diode transient thermal impedance as a function of pulse width ( $D = t_p/T$ )

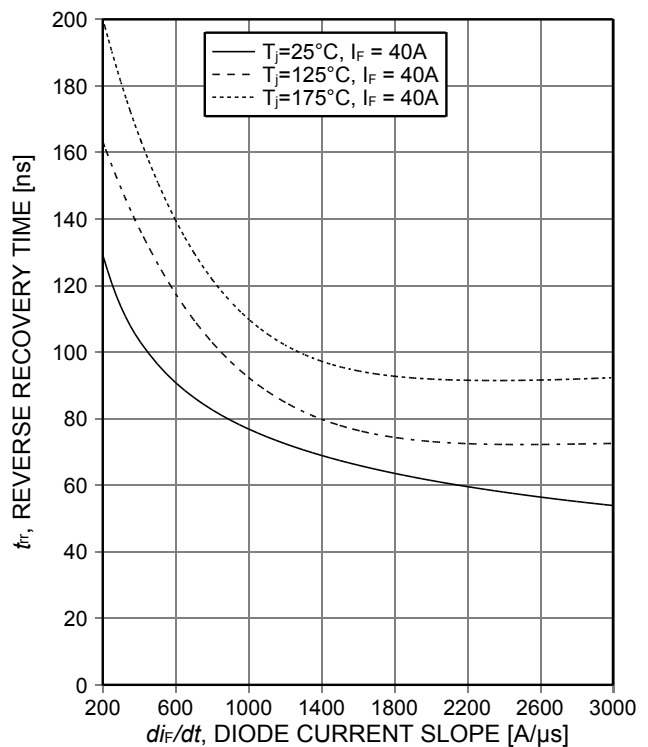


Figure 4. Typical reverse recovery time as a function of diode current slope ( $V_R = 400\text{V}$ )



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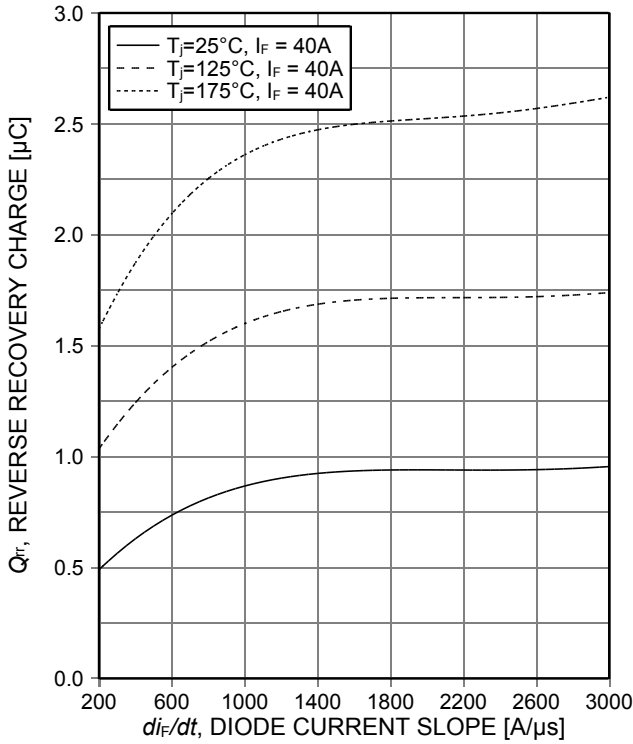


Figure 5. Typical reverse recovery charge as a function of diode current slope ( $V_R=400V$ )

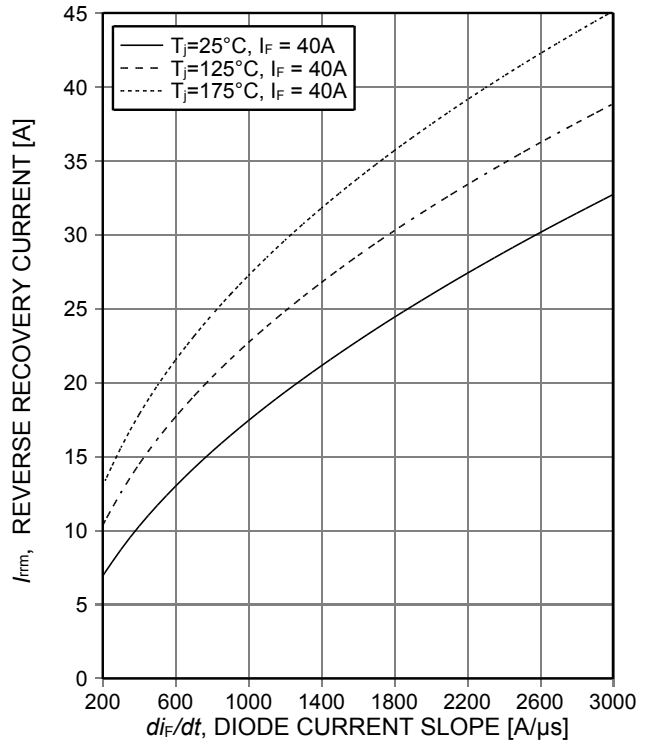


Figure 6. Typical peak reverse recovery current as a function of diode current slope ( $V_R=400V$ )

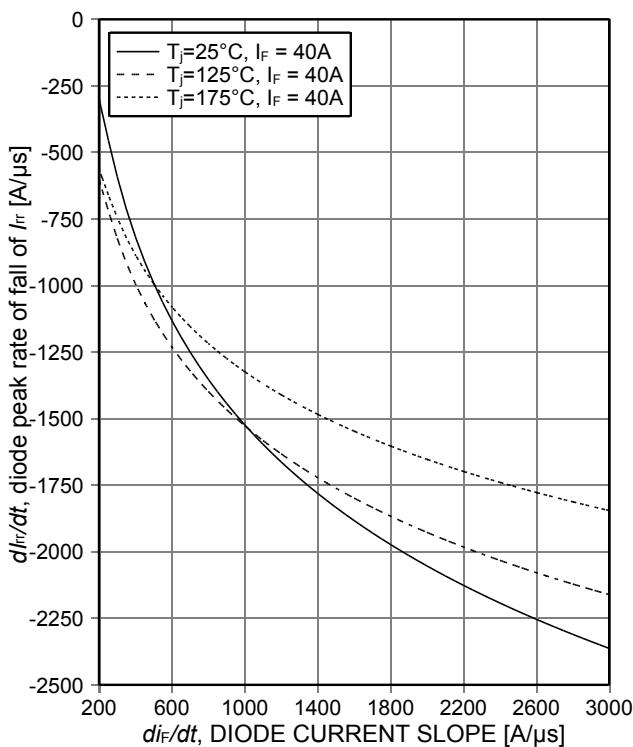


Figure 7. Typical diode peak rate of fall of reverse recovery current as a function of diode current slope ( $V_R=400V$ )

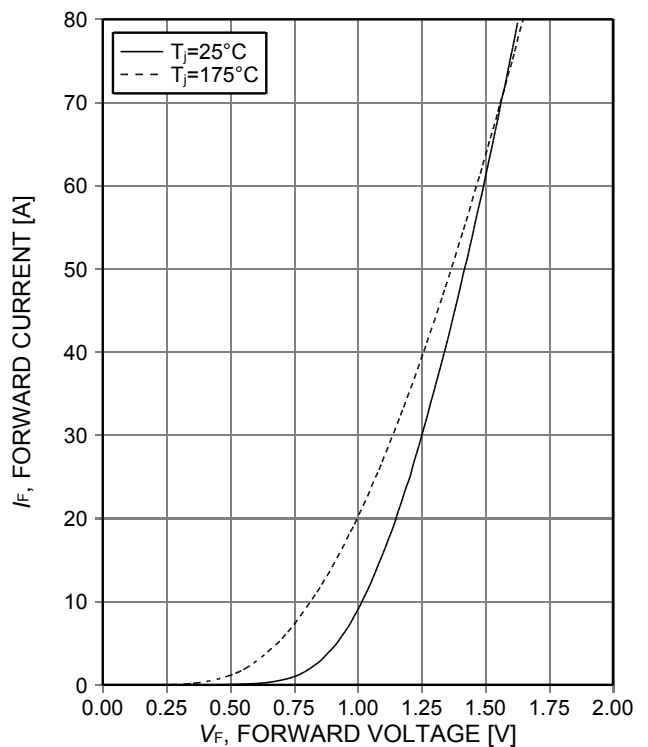


Figure 8. Typical diode forward current as a function of forward voltage





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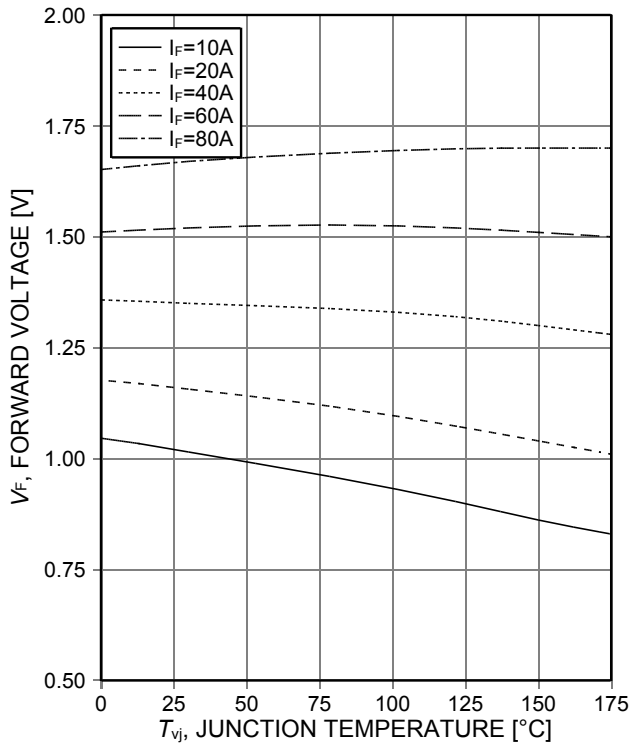


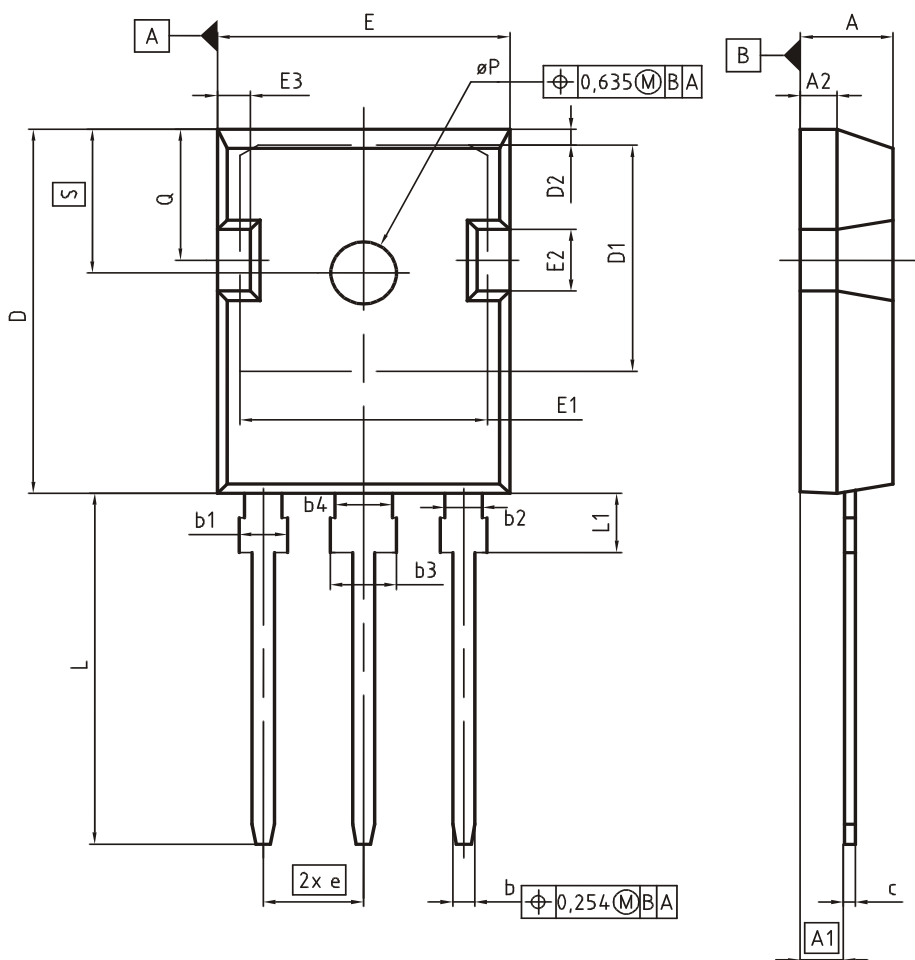
Figure 9. Typical diode forward voltage as a function of junction temperature



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**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

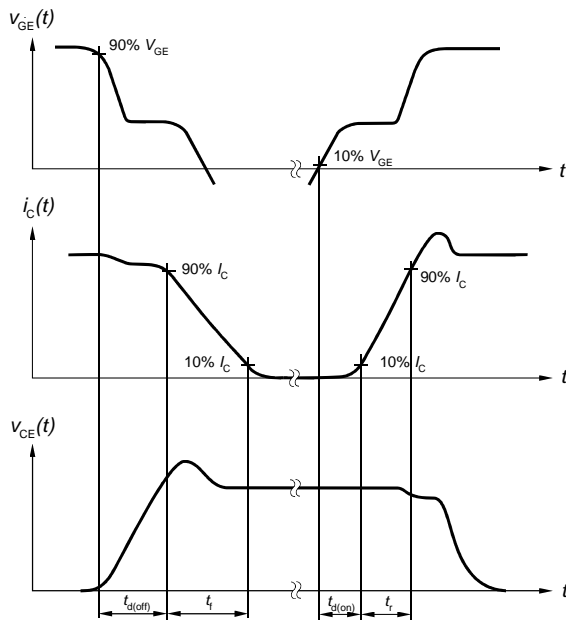
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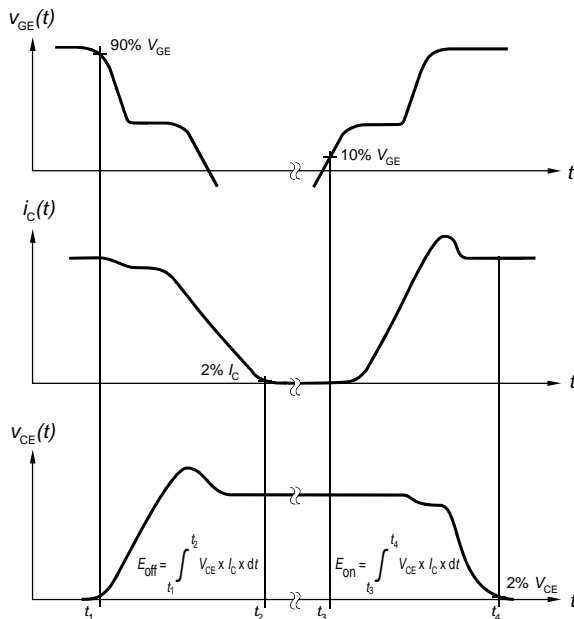
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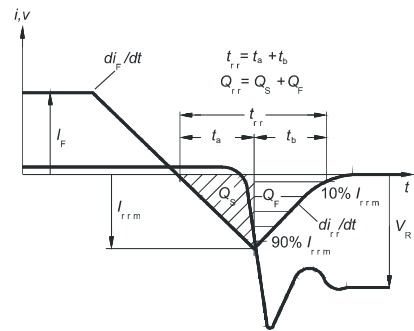
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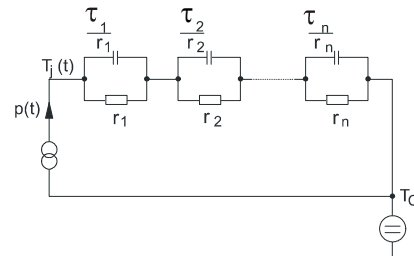
**Figure A. Definition of switching times**



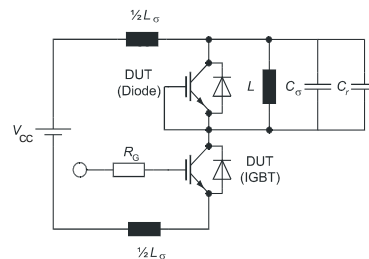
**Figure B. Definition of switching losses**



**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)

**IDW40E65D1****Emitter Controlled Diode Rapid 1 Series**

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## Revision History

IDW40E65D1

Revision: 2013-12-16, Rev. 2.2

## Previous Revision

Revision	Date	Subjects (major changes since last revision)
1.1	2013-03-13	Preliminary data sheet
2.1	2013-10-21	Final data sheet
2.2	2013-12-16	New Marking Pattern

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