

## Diode

Rapid Switching Emitter Controlled Diode

## IDP15E65D1

Emitter Controlled Diode Rapid 1 Series

Data sheet

Industrial Power Control

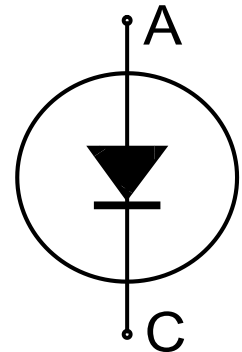
## Rapid Switching Emitter Controlled Diode

### 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



### Key Performance and Package Parameters

Type	$V_{rrm}$	$I_f$	$V_f, T_{vj}=25^\circ\text{C}$	$T_{vjmax}$	Marking	Package
IDP15E65D1	650V	15A	1.35V	175°C	E15ED1	PG-TO220-2-1



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## Emitter Controlled Diode Rapid 1 Series

**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 $T_{vjmax}$ $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	$I_F$	30.0 15.0	A
Diode pulsed current, $t_p$ limited by $T_{vjmax}$	$I_{Fpuls}$	45.0	A
Diode surge non repetitive forward current $T_C = 25^\circ\text{C}$ , $t_p = 10.0\text{ms}$ , sine halfwave	$I_{FSM}$	120.0	A
Power dissipation $T_C = 25^\circ\text{C}$	$P_{tot}$	92.0	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	$R_{th(j-c)}$		1.64	K/W
Thermal resistance junction - ambient	$R_{th(j-a)}$		62	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	$V_F$	$I_F = 15.0\text{A}$ $T_{vj} = 25^\circ\text{C}$ $T_{vj} = 125^\circ\text{C}$ $T_{vj} = 175^\circ\text{C}$	- - -	1.35 1.30 1.26	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	$L_E$		-	7.0	-	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	$t_{rr}$	$T_{vj} = 25^{\circ}\text{C}$ , $V_R = 400\text{V}$ , $I_F = 15.0\text{A}$ , $di_F/dt = 1000\text{A}/\mu\text{s}$	-	71	-	ns
Diode reverse recovery charge	$Q_{rr}$		-	0.37	-	$\mu\text{C}$
Diode peak reverse recovery current	$I_{rrm}$		-	8.6	-	A
Diode peak rate of fall of reverse recovery current during $t_b$	$di_{rr}/dt$		-	-810	-	$\text{A}/\mu\text{s}$
Diode reverse recovery time	$t_{rr}$	$T_{vj} = 25^{\circ}\text{C}$ , $V_R = 400\text{V}$ , $I_F = 15.0\text{A}$ , $di_F/dt = 200\text{A}/\mu\text{s}$	-	114	-	ns
Diode reverse recovery charge	$Q_{rr}$		-	0.28	-	$\mu\text{C}$
Diode peak reverse recovery current	$I_{rrm}$		-	3.4	-	A
Diode peak rate of fall of reverse recovery current during $t_b$	$di_{rr}/dt$		-	-150	-	$\text{A}/\mu\text{s}$

**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	$t_{rr}$	$T_{vj} = 175^{\circ}\text{C}$ , $V_R = 400\text{V}$ , $I_F = 15.0\text{A}$ , $di_F/dt = 1000\text{A}/\mu\text{s}$	-	95	-	ns
Diode reverse recovery charge	$Q_{rr}$		-	0.91	-	$\mu\text{C}$
Diode peak reverse recovery current	$I_{rrm}$		-	14.1	-	A
Diode peak rate of fall of reverse recovery current during $t_b$	$di_{rr}/dt$		-	-720	-	$\text{A}/\mu\text{s}$
Diode reverse recovery time	$t_{rr}$	$T_{vj} = 125^{\circ}\text{C}$ , $V_R = 400\text{V}$ , $I_F = 15.0\text{A}$ , $di_F/dt = 200\text{A}/\mu\text{s}$	-	146	-	ns
Diode reverse recovery charge	$Q_{rr}$		-	0.52	-	$\mu\text{C}$
Diode peak reverse recovery current	$I_{rrm}$		-	4.7	-	A
Diode peak rate of fall of reverse recovery current during $t_b$	$di_{rr}/dt$		-	-230	-	$\text{A}/\mu\text{s}$

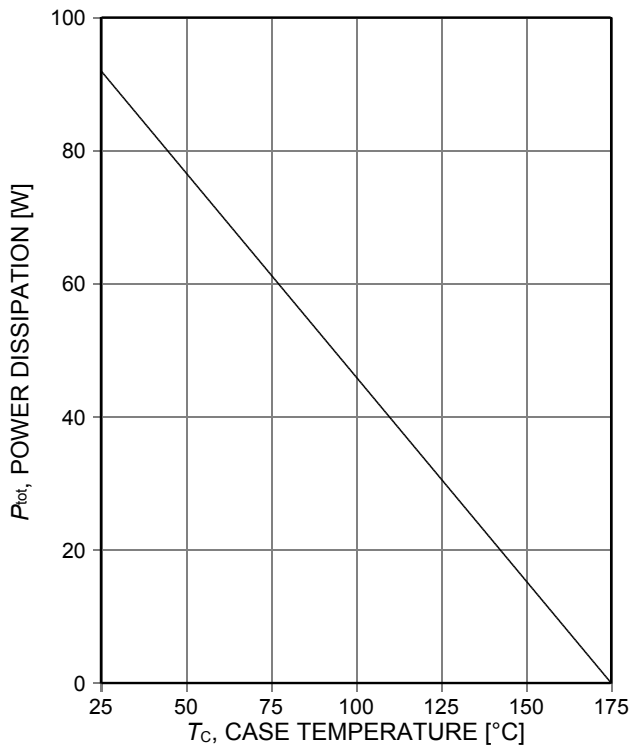


Figure 1. Power dissipation as a function of case temperature ( $T_{vj} \leq 175^\circ\text{C}$ )

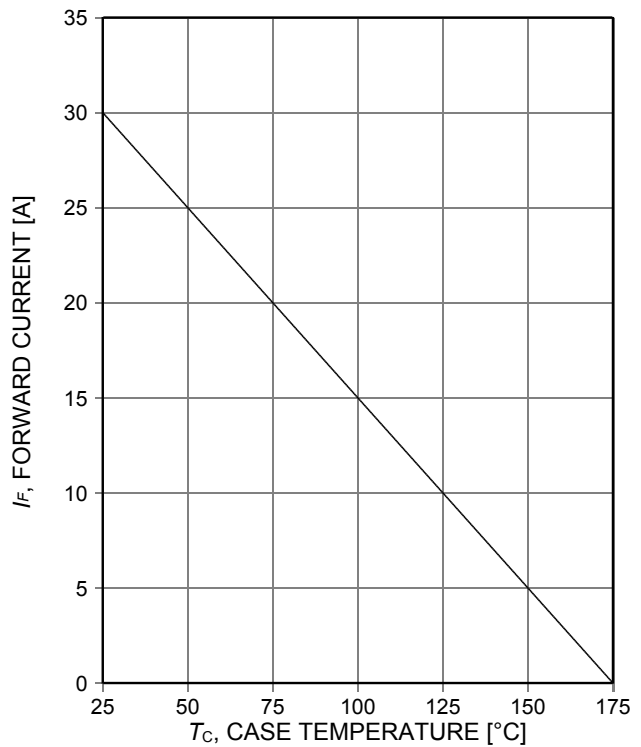


Figure 2. Diode forward current as a function of case temperature ( $T_{vj} \leq 175^\circ\text{C}$ )

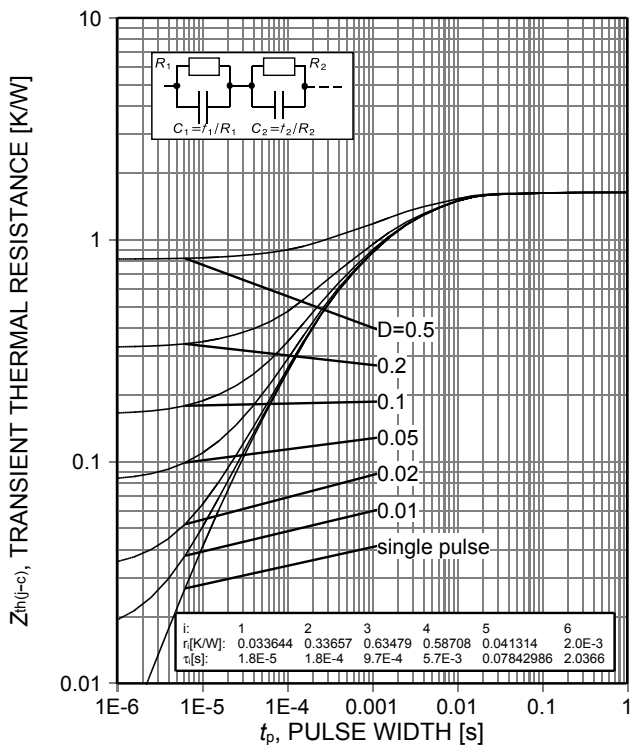


Figure 3. Diode transient thermal impedance as a function of pulse width ( $D = t_p/T$ )

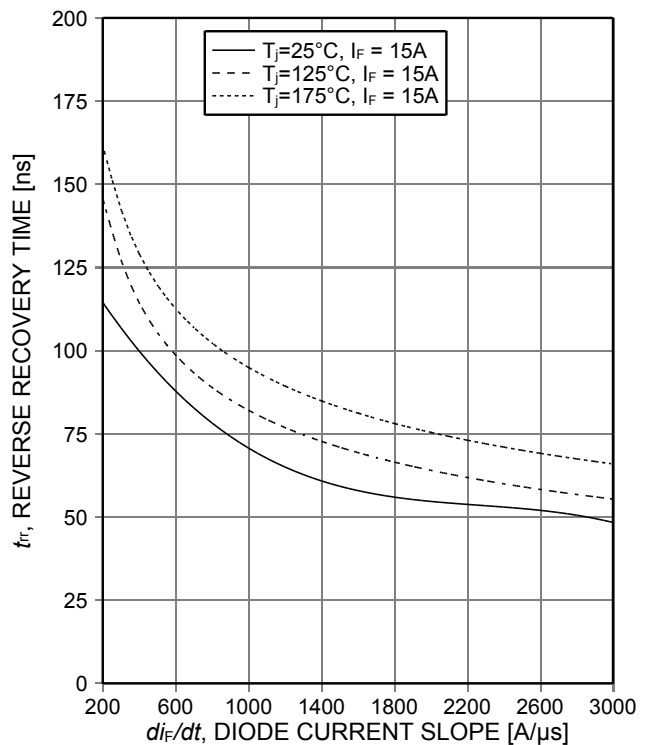


Figure 4. Typical reverse recovery time as a function of diode current slope ( $V_R = 400\text{V}$ )

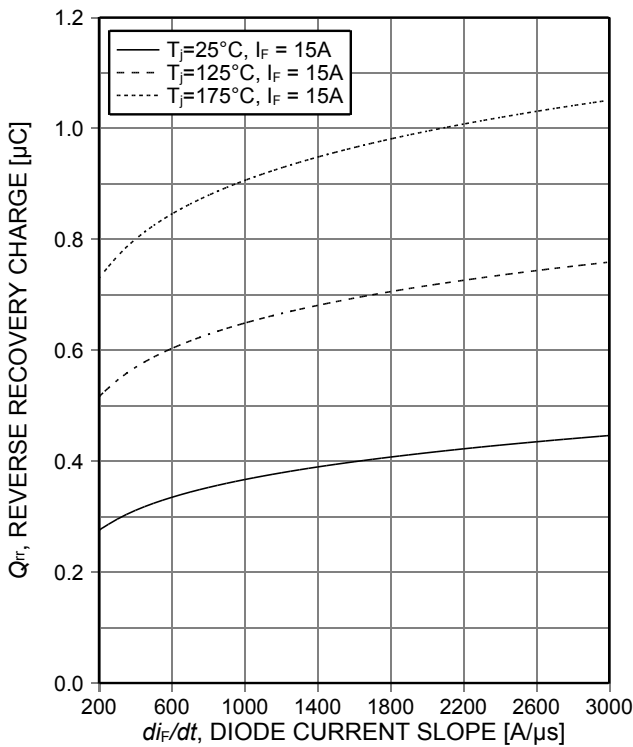


Figure 5. Typical reverse recovery charge as a function of diode current slope ( $V_R=400V$ )

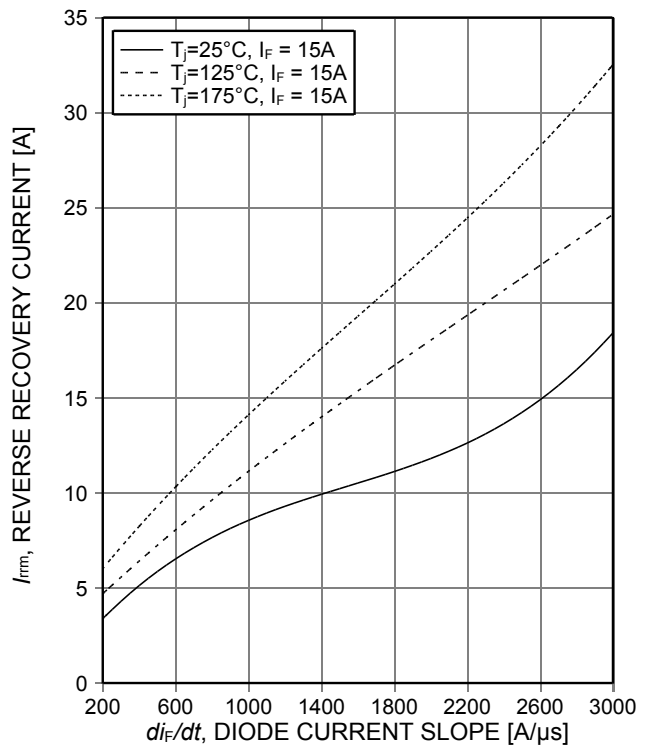


Figure 6. Typical peak reverse recovery current as a function of diode current slope ( $V_R=400V$ )

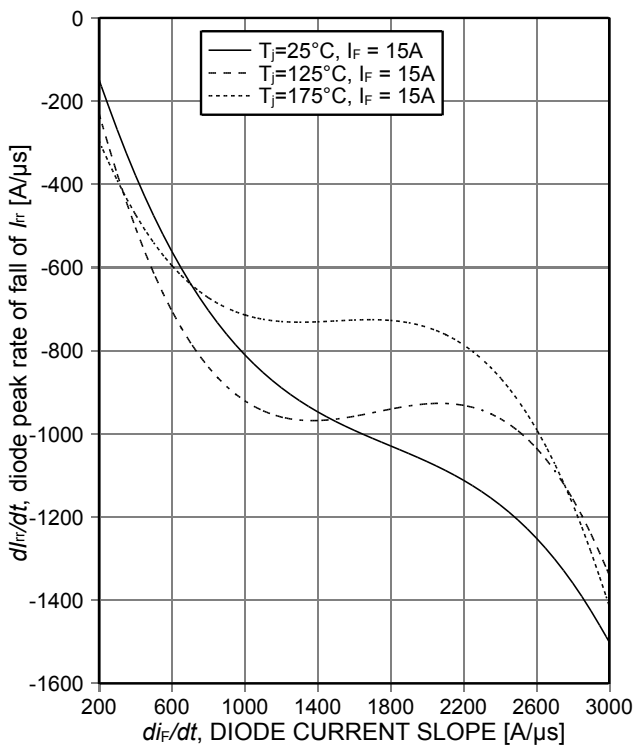


Figure 7. Typical diode peak rate of fall of reverse recovery current as a function of diode current slope ( $V_R=400V$ )

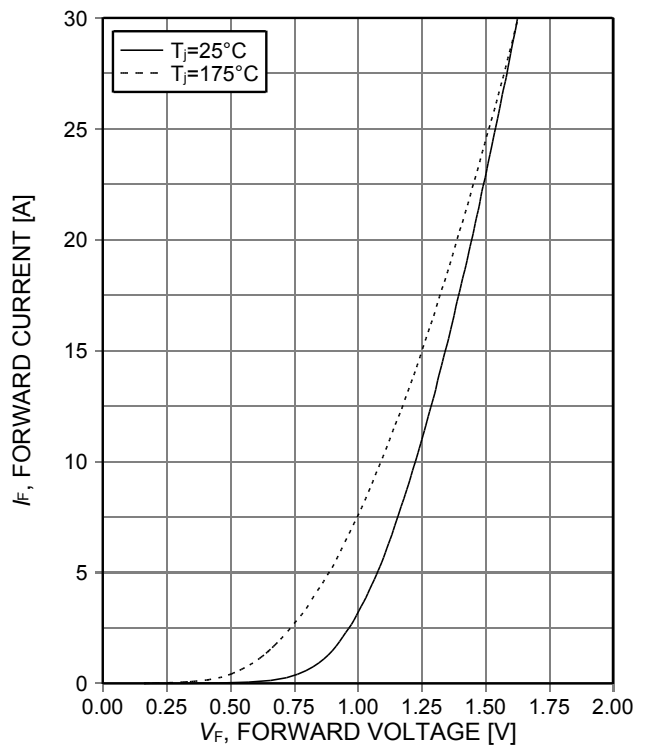


Figure 8. Typical diode forward current as a function of forward voltage

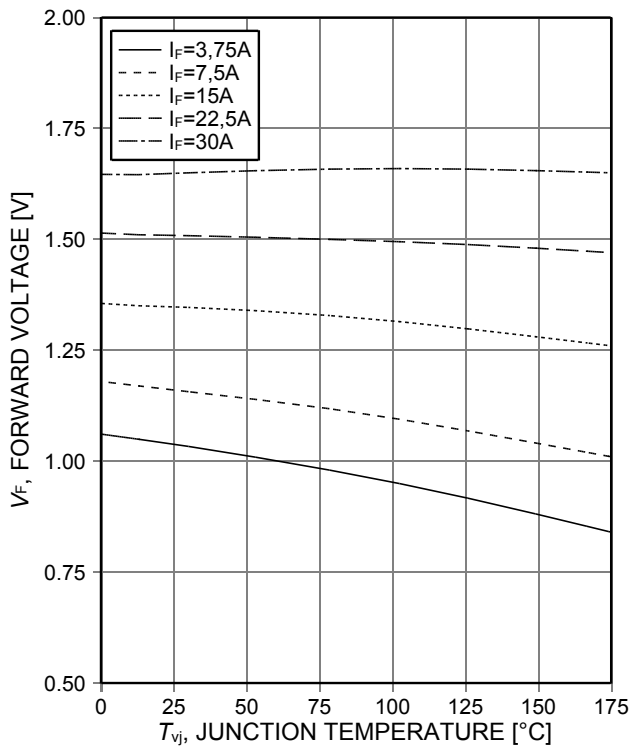
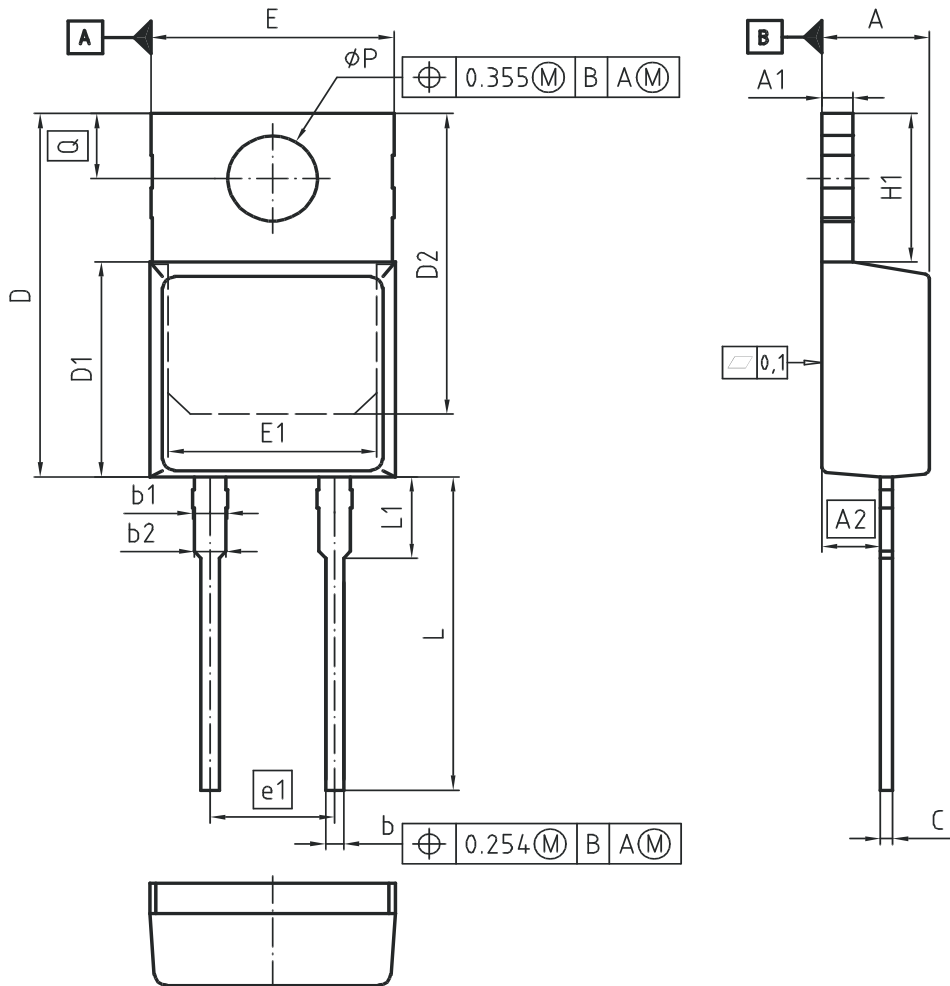


Figure 9. Typical diode forward voltage as a function of junction temperature



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
$\phi P$	3.55	3.70	0.140	0.146
Q	2.60	3.00	0.102	0.118

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Figure A. Definition of switching times



Figure B. Definition of switching losses

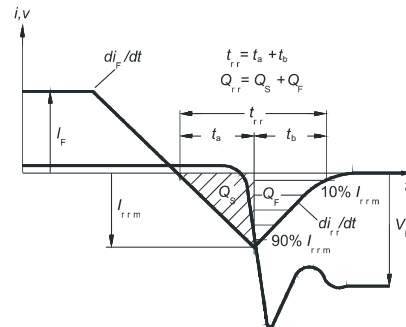


Figure C. Definition of diodes switching characteristics

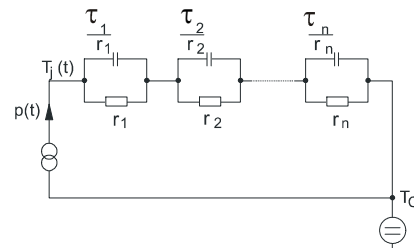


Figure D. Thermal equivalent circuit

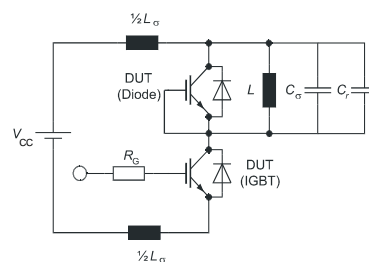


Figure E. Dynamic test circuit  
Parasitic inductance  $L_\sigma$ ,  
Parasitic capacitor  $C_\sigma$ ,  
Relief capacitor  $C_r$   
(only for ZVT switching)

## Revision History

IDP15E65D1

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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