

## Emitter Controlled Diode Rapid 1 Advanced Isolation

### Rapid Switching Emitter Controlled Diode in fully isolated package

#### Features:

- 650V Emitter Controlled technology
- Temperature stable behaviour of key parameters
- Low forward voltage ( $V_F$ )
- Low reverse recovery charge ( $Q_{rr}$ )
- Low reverse recovery current ( $I_{rrm}$ )
- Maximum junction temperature 175°C
- 2500 VRMS electrical isolation, 50/60 Hz,  $t = 1$  min
- 100 % tested isolated mounting surface
- Pb-free lead plating
- RoHS compliant

#### Potential Applications:

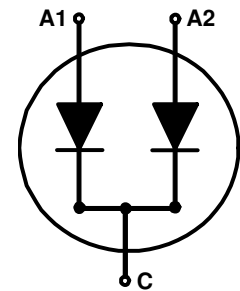
- Air Conditioning
- GPD (General Purpose Drives)
- Industrial SMPS

#### Package pin definition:

- Pin 1 - anode (A1)
- Pin 2 - cathode (C)
- Pin 3 - anode (A2)

#### Product Validation:

Qualified for industrial applications according to the relevant tests of JEDEC 47/20/22



Fully isolated package TO-247



#### Key Performance and Package Parameters

Type	$V_{rrm}$	$I_f$	$V_f, T_{vj}=25^\circ\text{C}$	$T_{vjmax}$	Marking	Package
IDFW60C65D1	650V	2x 30A	1.45V	175°C	D60C65D1	PG-TO247-3-AI

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## Emitter Controlled Diode Rapid 1 Advanced Isolation

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## Emitter Controlled Diode Rapid 1 Advanced Isolation

### Maximum Ratings (per leg)

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, $T_{vj} \geq 25^{\circ}\text{C}$	$V_{RRM}$	650	V
Diode forward current, limited by $T_{vjmax}$ $T_h = 25^{\circ}\text{C}$ $T_h = 65^{\circ}\text{C}$	$I_F$	56.0 43.0	A
Diode pulsed current, $t_p$ limited by $T_{vjmax}$	$I_{Fpuls}$	90.0	A
Diode surge non repetitive forward current $T_h = 25^{\circ}\text{C}$ , $t_p = 10.0\text{ms}$ , sine halfwave	$I_{FSM}$	240.0	A
Power dissipation $T_h = 25^{\circ}\text{C}$ Power dissipation $T_h = 65^{\circ}\text{C}$	$P_{tot}$	100.0 73.0	W
Operating junction temperature	$T_{vj}$	-40...+175	$^{\circ}\text{C}$
Storage temperature	$T_{stg}$	-55...+150	$^{\circ}\text{C}$
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s		260	$^{\circ}\text{C}$
Mounting torque, M3 screw Maximum of mounting processes: 3	$M$	0.6	Nm
Isolation voltage RMS, $f = 50/60\text{Hz}$ , $t = 1\text{min}^{1)}$	$V_{isol}$	2500	V

### Thermal Resistances (per leg)

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>R<sub>th</sub> Characteristics</b>						
Diode thermal resistance, <sup>2)</sup> junction - heatsink	$R_{th(j-h)}$		-	1.37	1.50	K/W
Thermal resistance junction - ambient	$R_{th(j-a)}$		-	-	65	K/W

### Electrical Characteristics (per leg), 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	$V_F$	$I_F = 30.0\text{A}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	- - -	1.45 1.42 1.40	1.75 - -	V
Reverse leakage current <sup>3)</sup>	$I_R$	$V_R = 650\text{V}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	- -	- 1200	40 -	$\mu\text{A}$

<sup>1)</sup> For a proper handling and assembly of the advanced isolation device in the application refer to the note at the package drawing.

<sup>2)</sup> At force on body  $F = 500\text{N}$ ,  $T_a = 25^{\circ}\text{C}$

<sup>3)</sup> Reverse leakage current per leg specified for operating conditions with zero voltage applied to the other leg.

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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

## Switching Characteristics (per leg), Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>Diode Characteristic, at <math>T_{vj} = 25^{\circ}\text{C}</math></b>						
Diode reverse recovery time	$t_{rr}$	$T_{vj} = 25^{\circ}\text{C}$ , $V_R = 400\text{V}$ , $I_F = 30.0\text{A}$ , $di_F/dt = 1000\text{A}/\mu\text{s}$ , $L\sigma = 30\text{nH}$ , $C\sigma = 40\text{pF}$ , switch IGW50N65H5.	-	65	-	ns
Diode reverse recovery charge	$Q_{rr}$		-	0.76	-	$\mu\text{C}$
Diode peak reverse recovery current	$I_{rrm}$		-	17.6	-	A
Diode peak rate of fall of reverse recovery current during $t_b$	$di_{rr}/dt$		-	-1360	-	$\text{A}/\mu\text{s}$
Diode reverse recovery time	$t_{rr}$	$T_{vj} = 25^{\circ}\text{C}$ , $V_R = 400\text{V}$ , $I_F = 30.0\text{A}$ , $di_F/dt = 200\text{A}/\mu\text{s}$ , $L\sigma = 30\text{nH}$ , $C\sigma = 40\text{pF}$ , switch IGW50N65H5.	-	112	-	ns
Diode reverse recovery charge	$Q_{rr}$		-	0.47	-	$\mu\text{C}$
Diode peak reverse recovery current	$I_{rrm}$		-	4.5	-	A
Diode peak rate of fall of reverse recovery current during $t_b$	$di_{rr}/dt$		-	-655	-	$\text{A}/\mu\text{s}$

## Switching Characteristics (per leg), Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>Diode Characteristic, at <math>T_{vj} = 175^{\circ}\text{C}/125^{\circ}\text{C}</math></b>						
Diode reverse recovery time	$t_{rr}$	$T_{vj} = 175^{\circ}\text{C}$ , $V_R = 400\text{V}$ , $I_F = 30.0\text{A}$ , $di_F/dt = 1000\text{A}/\mu\text{s}$ , $L\sigma = 30\text{nH}$ , $C\sigma = 40\text{pF}$ , switch IGW50N65H5.	-	102	-	ns
Diode reverse recovery charge	$Q_{rr}$		-	1.80	-	$\mu\text{C}$
Diode peak reverse recovery current	$I_{rrm}$		-	25.9	-	A
Diode peak rate of fall of reverse recovery current during $t_b$	$di_{rr}/dt$		-	-995	-	$\text{A}/\mu\text{s}$
Diode reverse recovery time	$t_{rr}$	$T_{vj} = 125^{\circ}\text{C}$ , $V_R = 400\text{V}$ , $I_F = 30.0\text{A}$ , $di_F/dt = 200\text{A}/\mu\text{s}$ , $L\sigma = 30\text{nH}$ , $C\sigma = 40\text{pF}$ , switch IGW50N65H5.	-	148	-	ns
Diode reverse recovery charge	$Q_{rr}$		-	0.98	-	$\mu\text{C}$
Diode peak reverse recovery current	$I_{rrm}$		-	8.5	-	A
Diode peak rate of fall of reverse recovery current during $t_b$	$di_{rr}/dt$		-	-485	-	$\text{A}/\mu\text{s}$

Emitter Controlled Diode Rapid 1 Advanced Isolation

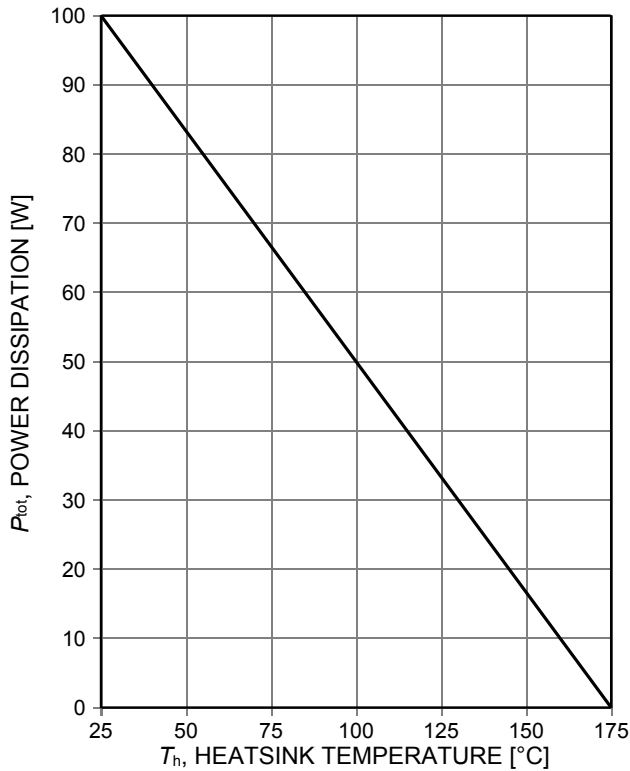


Figure 1. Power dissipation per leg as a function of heatsink temperature ( $T_{vj} \leq 175^\circ\text{C}$ )

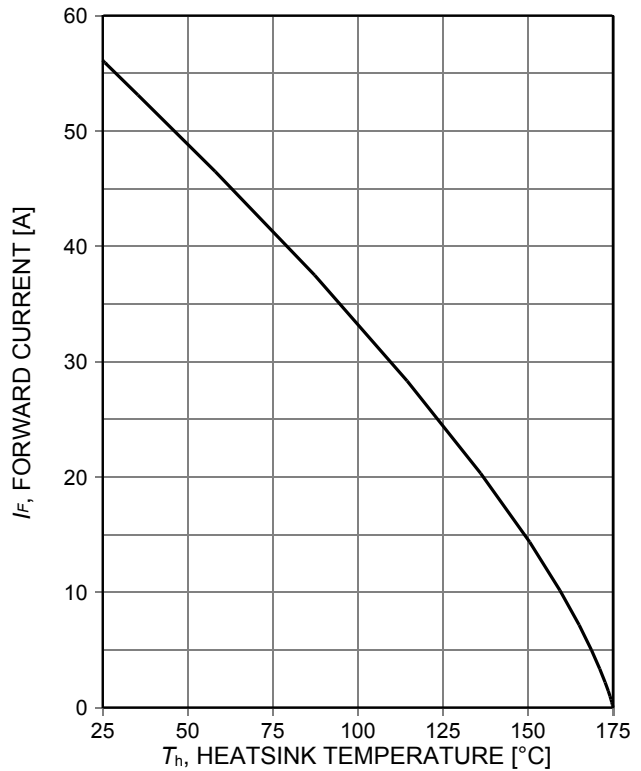


Figure 2. Diode forward current per leg as a function of heatsink temperature ( $T_{vj} \leq 175^\circ\text{C}$ )

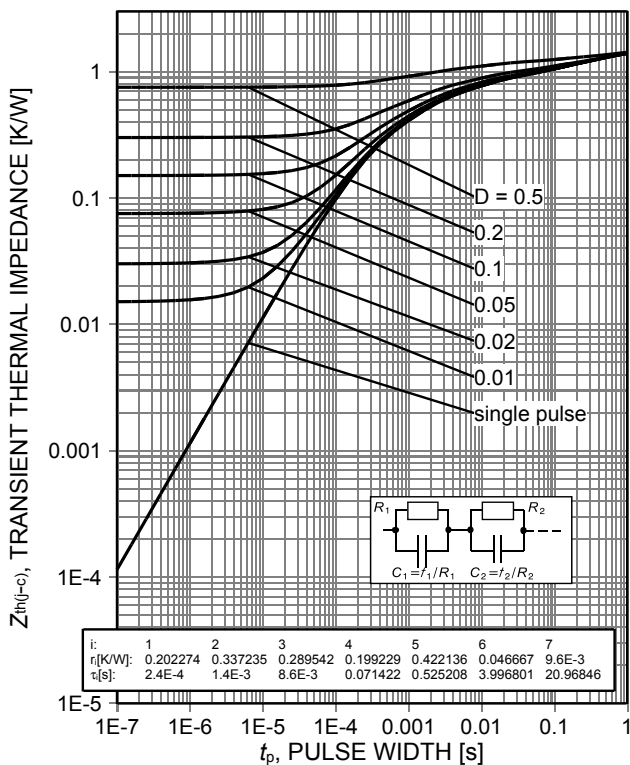


Figure 3. Diode transient thermal impedance per leg as a function of pulse width ( $D = t_p/T$ )

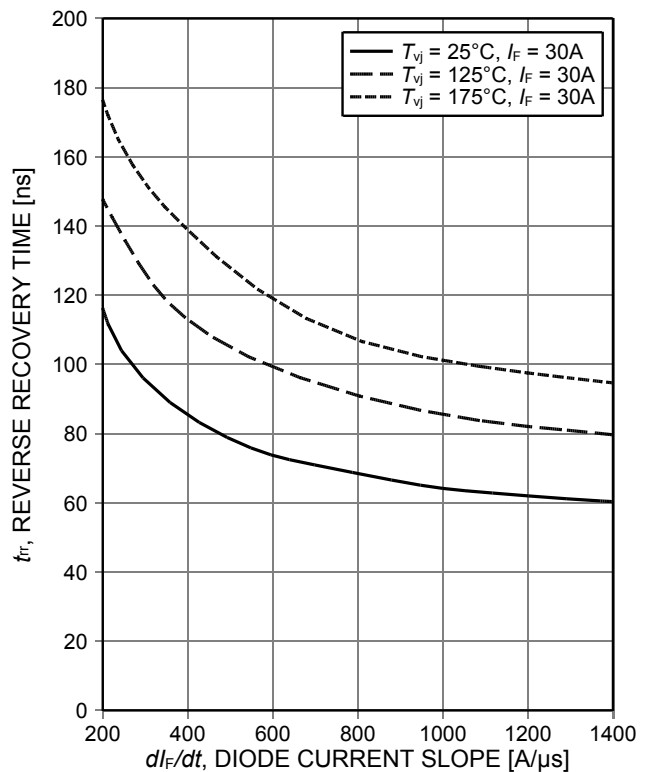


Figure 4. Typical reverse recovery time per leg as a function of diode current slope ( $V_R = 400\text{V}$ )

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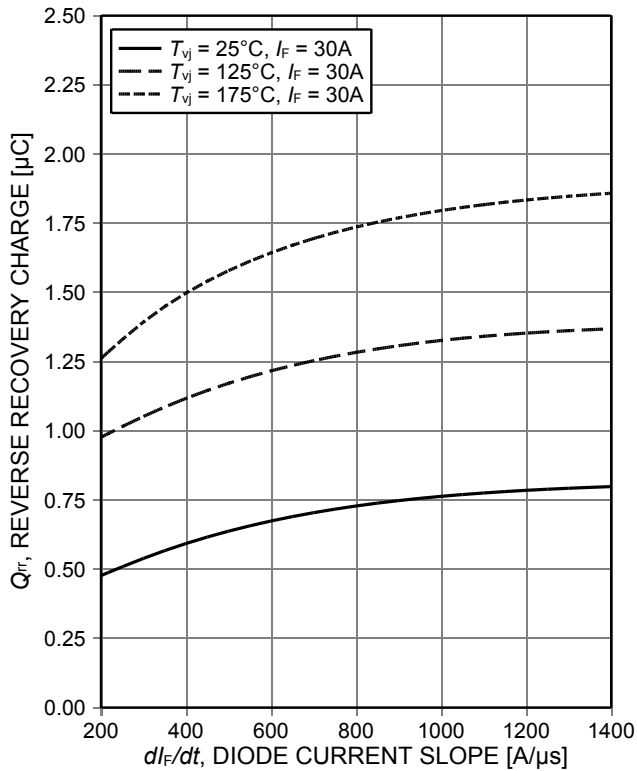


Figure 5. Typical reverse recovery charge per leg as a function of diode current slope ( $V_R=400V$ )

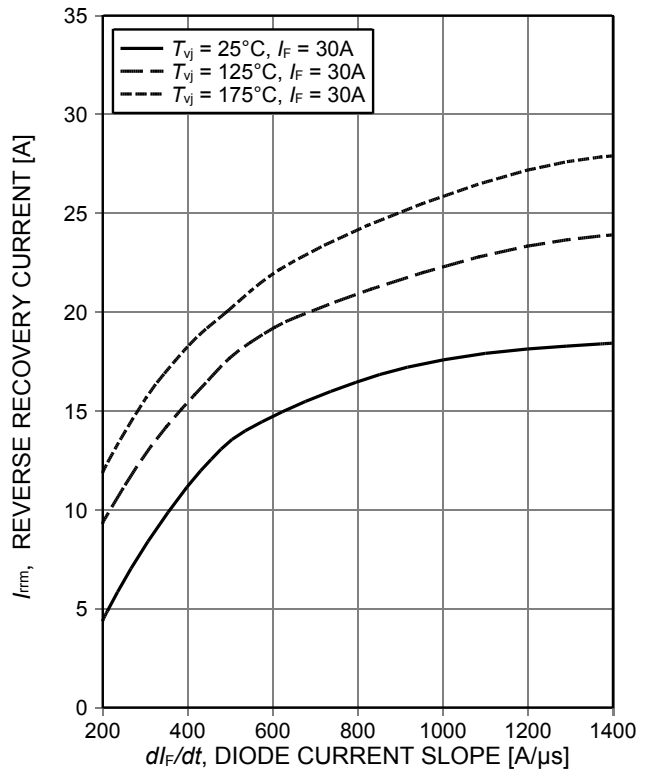


Figure 6. Typical peak reverse recovery current per leg as a function of diode current slope ( $V_R=400V$ )

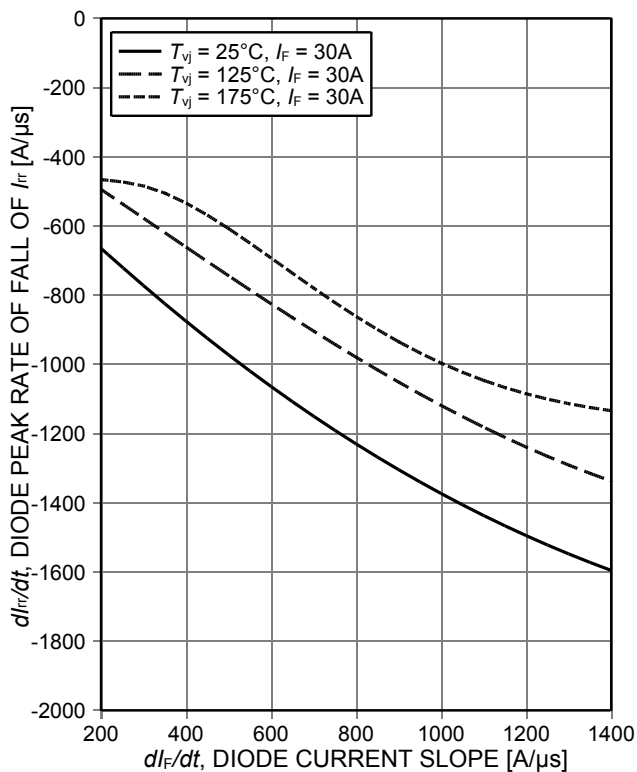


Figure 7. Typical diode peak rate of fall of rev. rec. current per leg as a function of diode current slope ( $V_R=400V$ )

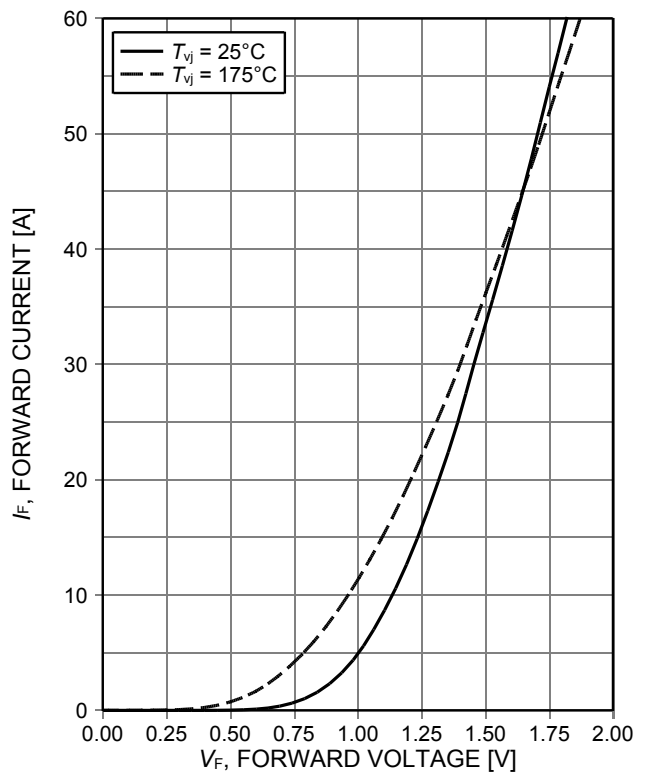


Figure 8. Typical diode forward current per leg as a function of forward voltage

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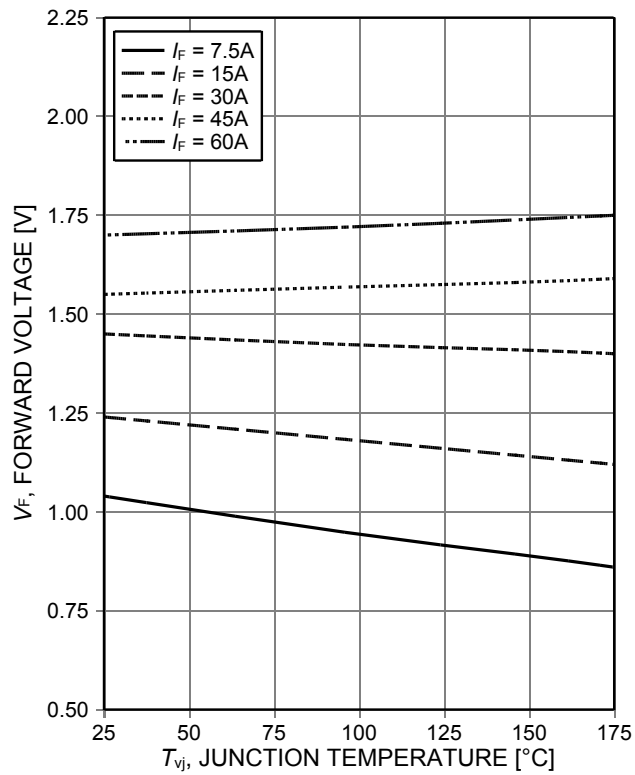
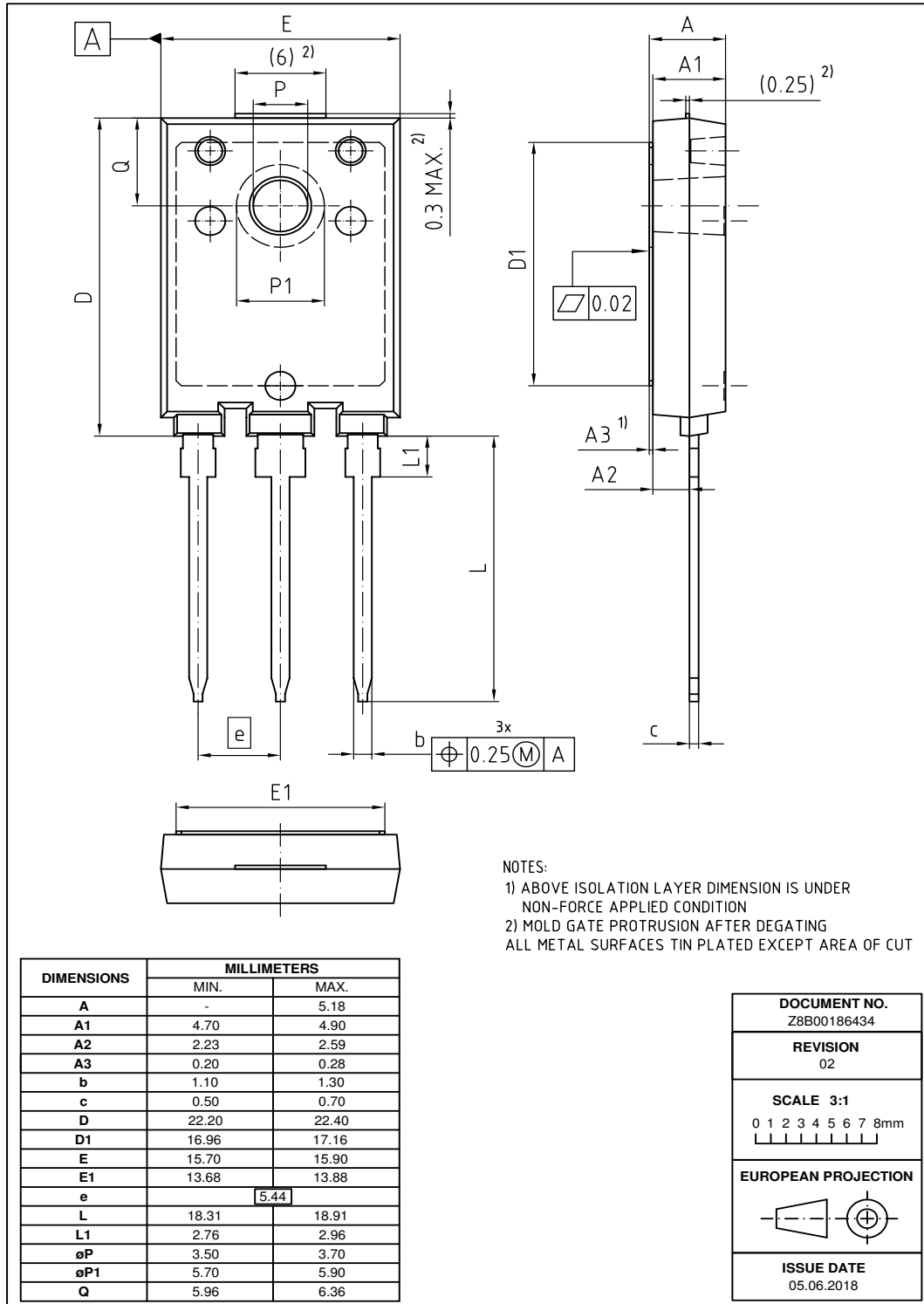


Figure 9. Typical diode forward voltage per leg as a function of junction temperature

**PG-TO247-3-AI (PG-HSIP247-3)**



Note: For a proper handling and assembly of the advanced isolation device in the application the isolation layer must not be exposed to potential penetration via sharp implements or mechanical impacts/shocks, which exceed levels indicated in International Standard (IEC60068-2-6 and IEC60068-2-27). The advanced isolation device is intended only to be used assembled on an appropriate heatsink with recommended flatness of <20µm per 100mm and roughness of <10µm.



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Testing Conditions

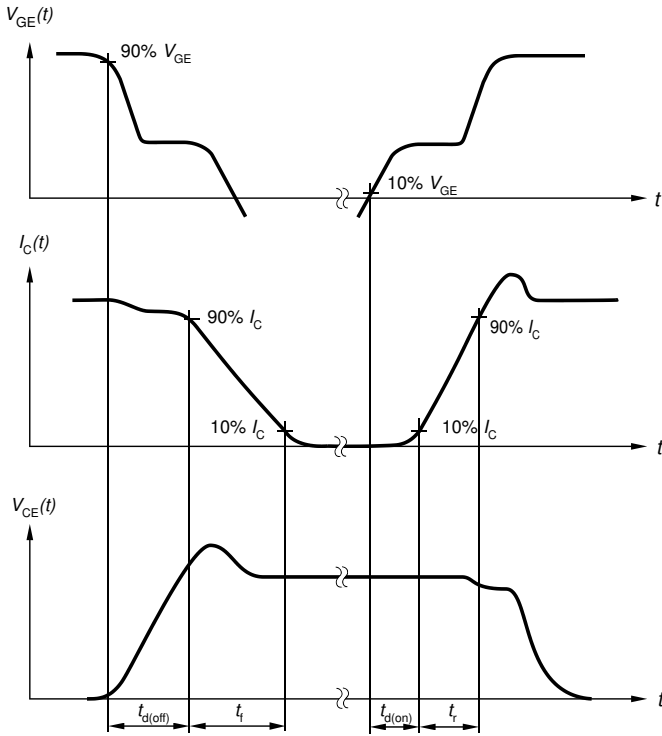


Figure A. Definition of switching times

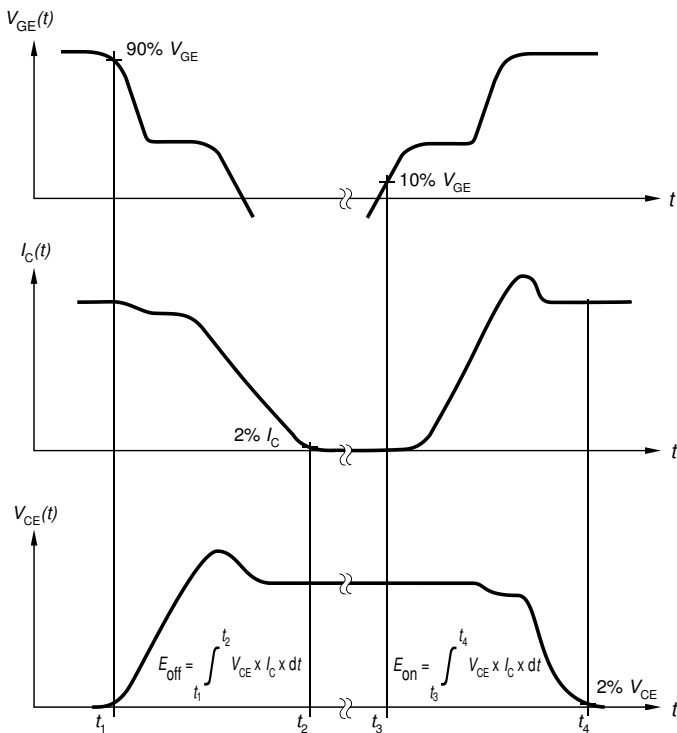


Figure B. Definition of switching losses

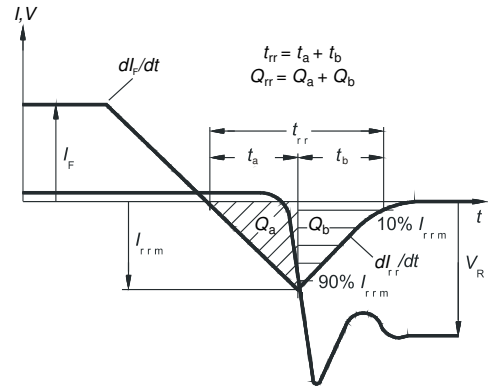


Figure C. Definition of diode switching characteristics

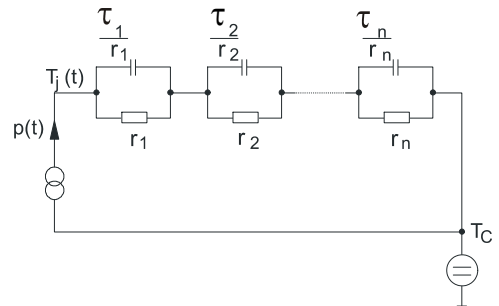


Figure D. Thermal equivalent circuit

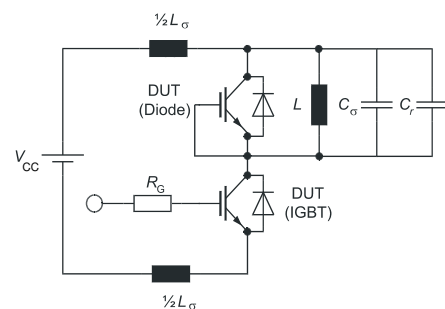


Figure E. Dynamic test circuit  
Parasitic inductance  $L_{\sigma}$ ,  
parasitic capacitor  $C_{\sigma}$ ,  
relief capacitor  $C_r$ ,  
(only for ZVT switching)

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## Emitter Controlled Diode Rapid 1 Advanced Isolation

### Revision History

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IDFW60C65D1

**Revision: 2018-06-20, Rev. 2.1**

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Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.1	2018-06-20	Final data sheet

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