Emitter Controlled Rapid-1 Diode in Advanced Isolation with fully isolated package

Features

- V_{RRM} = 650 V
- I_F = 2x 40 A
- 650 V 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 T_{vjmax} = 175°C
- 2500 V_{RMS} electrical isolation, 50/60 Hz, t = 1 min
- 100% tested isolated mounting surface
- Pb-free lead plating
- RoHS compliant

Fully isolated package TO-247

Lead-free
Green
Halogen-free
RoHS

Potential applications

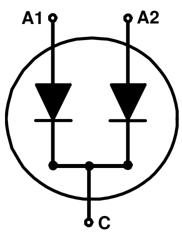
- Air conditioning
- General purpose drives (GPD)
- Industrial SMPS

Product validation

- Qualified for industrial applications according to the relevant tests of JEDEC47/20/22

Description

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



Type	Package	Marking
IDFW80C65D1	PG-TO247-3-AI	C80ED1

Table of contents

1 Package

Table 1 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Isolation test voltage RMS[1)]	V_{isol}				2500	V
Internal emitter inductance measured 5 mm (0.197 in.) from case	L_E			13.0		nH
Storage temperature	T_{stg}		-55		150	°C
Soldering temperature		wave soldering 1.6mm (0.063in.) from case for 10s			260	°C
Mounting torque	M	M3 screw Maximum of mounting process: 3			0.6	Nm
Thermal resistance, junction-ambient	$R_{th(j-a)}$				65	K/W

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

2 Diode

Table 2 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}	$T_{vj} \geq 25$ °C		650	V
Diode forward current, limited by T_{vjmax}	I_F		$T_h = 25$ °C	74	A
			$T_h = 65$ °C	59	
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpulse}			160	A
Diode surge non repetitive forward current, sine halfwave	I_{FSM}	$T_h = 25$ °C, $t_P = 10$ ms		320	A
Power dissipation	P_{tot}		$T_h = 25$ °C	112	W
			$T_h = 65$ °C	82	

Table 3 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode forward voltage	V_F	$I_F = 40$ A	$T_{vj} = 25$ °C		1.45	1.7	V
			$T_{vj} = 175$ °C		1.39		
Reverse leakage current[1)]	I_R	$V_R = 650$ V	$T_{vj} = 25$ °C			40	µA
			$T_{vj} = 175$ °C		1200		

(table continues...)

Table 3 **(continued) Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode reverse recovery time	t_{rr}	V_R = 400 V	T_{vj} = 25 °C, I_F = 40 A, $-di_F/dt$ = 820 A/µs		73		ns
			T_{vj} = 150 °C, I_F = 40 A, $-di_F/dt$ = 820 A/µs		120		
Diode reverse recovery charge	Q_{rr}	V_R = 400 V	T_{vj} = 25 °C, I_F = 40 A, $-di_F/dt$ = 820 A/µs		1.1		µC
			T_{vj} = 150 °C, I_F = 40 A, $-di_F/dt$ = 820 A/µs		2.62		
Diode peak reverse recovery current	I_{rrm}	V_R = 400 V	T_{vj} = 25 °C, I_F = 40 A, $-di_F/dt$ = 820 A/µs		23.5		A
			T_{vj} = 150 °C, I_F = 40 A, $-di_F/dt$ = 820 A/µs		36		
Diode peak rate of fall of reverse recovery current	di_{rr}/dt	V_R = 400 V	T_{vj} = 25 °C, I_F = 40 A, $-di_F/dt$ = 820 A/µs		1500		A/µs
			T_{vj} = 150 °C, I_F = 40 A, $-di_F/dt$ = 820 A/µs		1250		
Diode thermal resistance, junction - heatsink[2)]	R_{thjh}				1.14	1.34	K/W
Operating junction temperature	T_{vj}			-40		175	°C

1) Reverse leakage current per leg specified for operating conditions with zero voltage applied to the other leg.
2) At force on body F = 500N, T_a = 25°C

Note: *For optimum lifetime and reliability, Infineon recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.*

Electrical Characteristic (per leg) at T_{vj} = 25°C, unless otherwise specified.

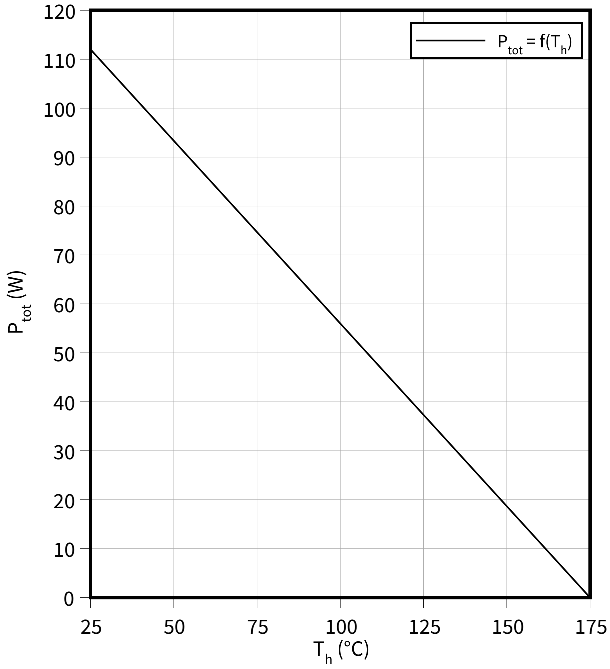
Dynamic test circuit, L_σ = 30 nH, C_σ = 40 pF, switch IKW40N65ES5.

3 Characteristics diagrams

Power dissipation per leg as a function of heatsink temperature

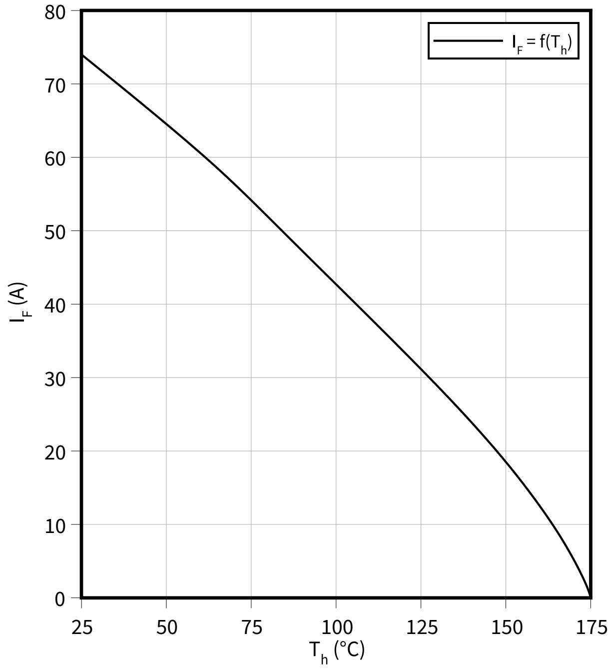
$P_{tot} = f(T_h)$

$T_{vj} \leq 175\ °C$



Diode forward current per leg as a function of heatsink temperature

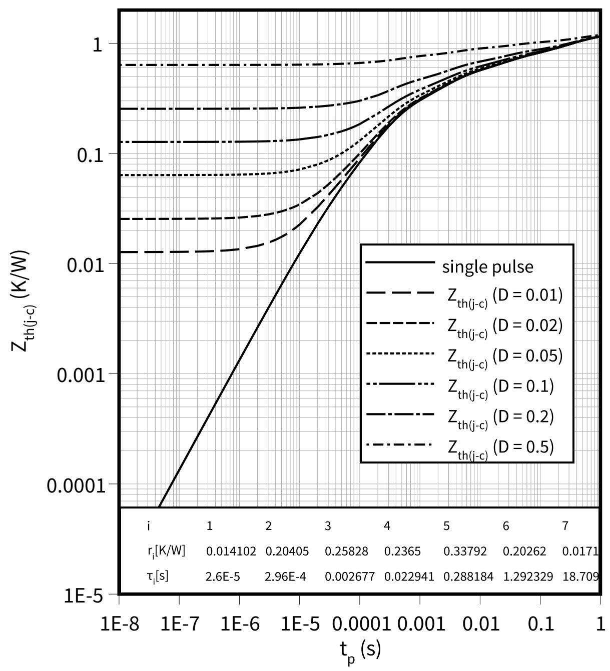
$I_F = f(T_h)$



Diode transient thermal impedance per leg as a function of pulse width

$Z_{th(j-c)} = f(t_p)$

$D = t_p/T$

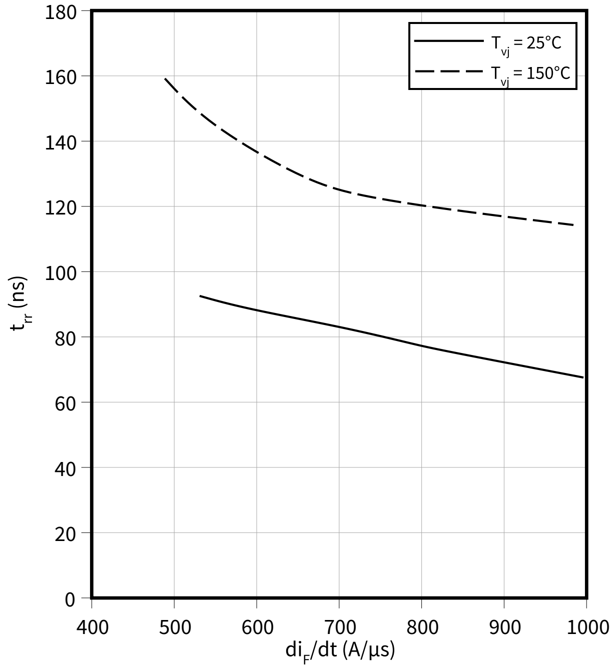


i	1	2	3	4	5	6	7
r_i[K/W]	0.014102	0.20405	0.25828	0.2365	0.33792	0.20262	0.0171
τ_i[s]	2.6E-5	2.96E-4	0.002677	0.022941	0.288184	1.292329	18.709

Typical reverse recovery time per leg as a function of diode current slope

$t_{rr} = f(di_F/dt)$

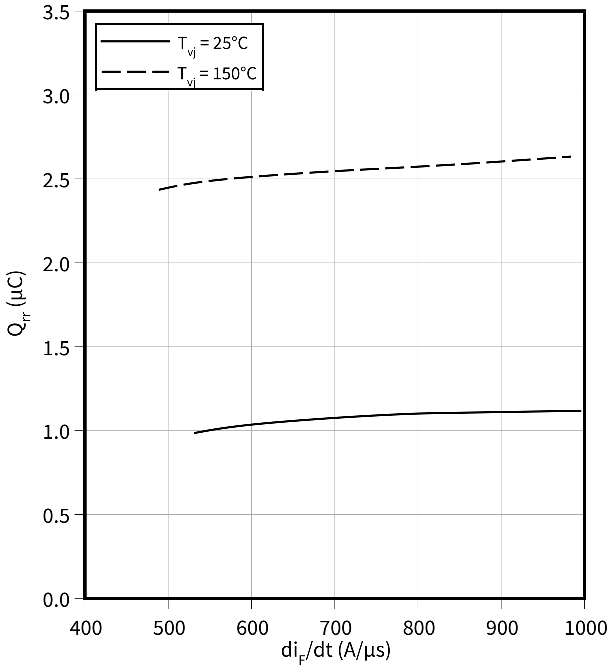
$V_R = 400\ V,\ I_F = 40\ A$



Typical reverse recovery charge per leg as a function of diode current slope

$Q_{rr} = f(di_F/dt)$

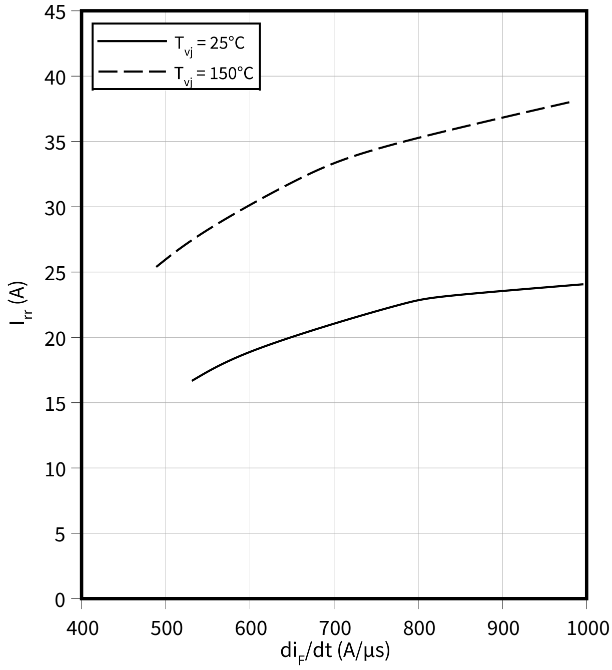
$V_R = 400$ V, $I_F = 40$ A



Typical reverse recovery current per leg as a function of diode current slope

$I_{rr} = f(di_F/dt)$

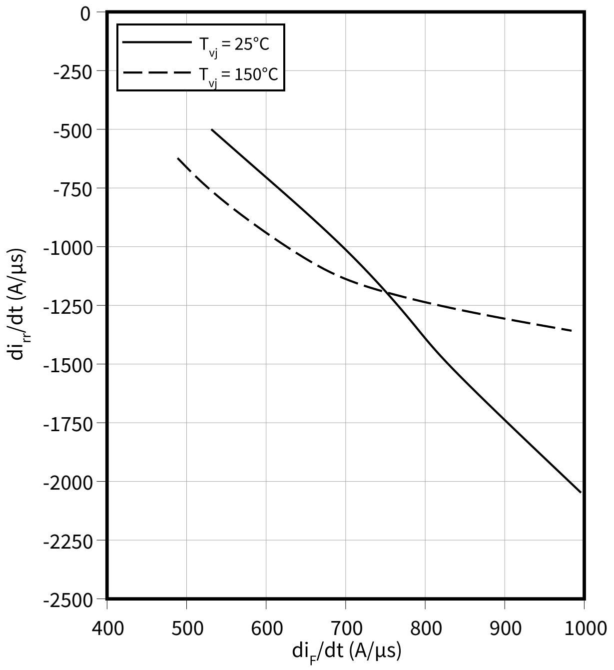
$V_R = 400$ V, $I_F = 40$ A



Typical diode peak rate of fall of reverse recovery current per leg as a function of diode current slope

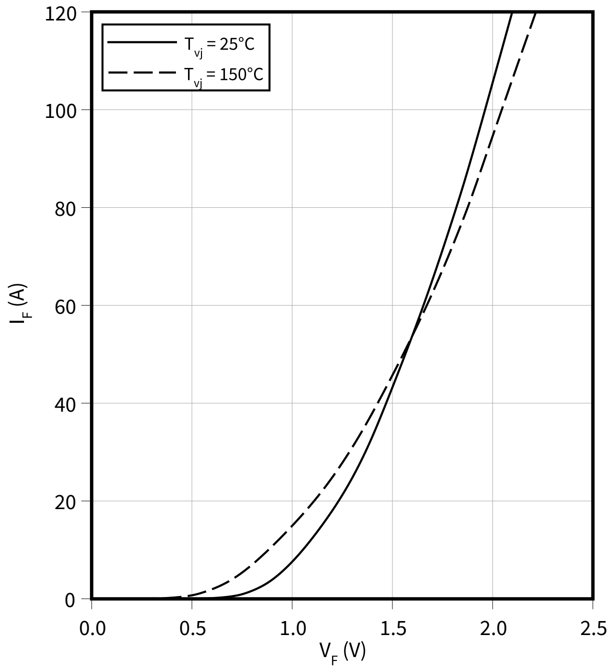
$di_{rr}/dt = f(di_F/dt)$

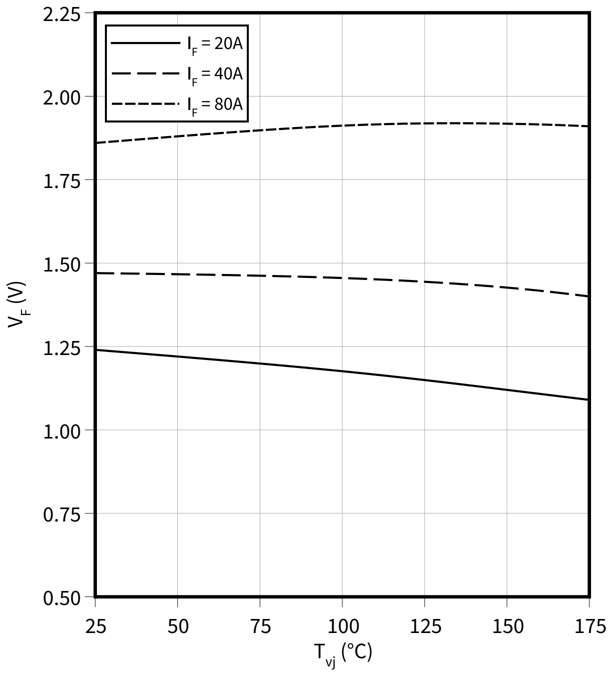
$V_R = 400$ V, $I_F = 40$ A



Typical diode forward current per leg as a function of forward voltage

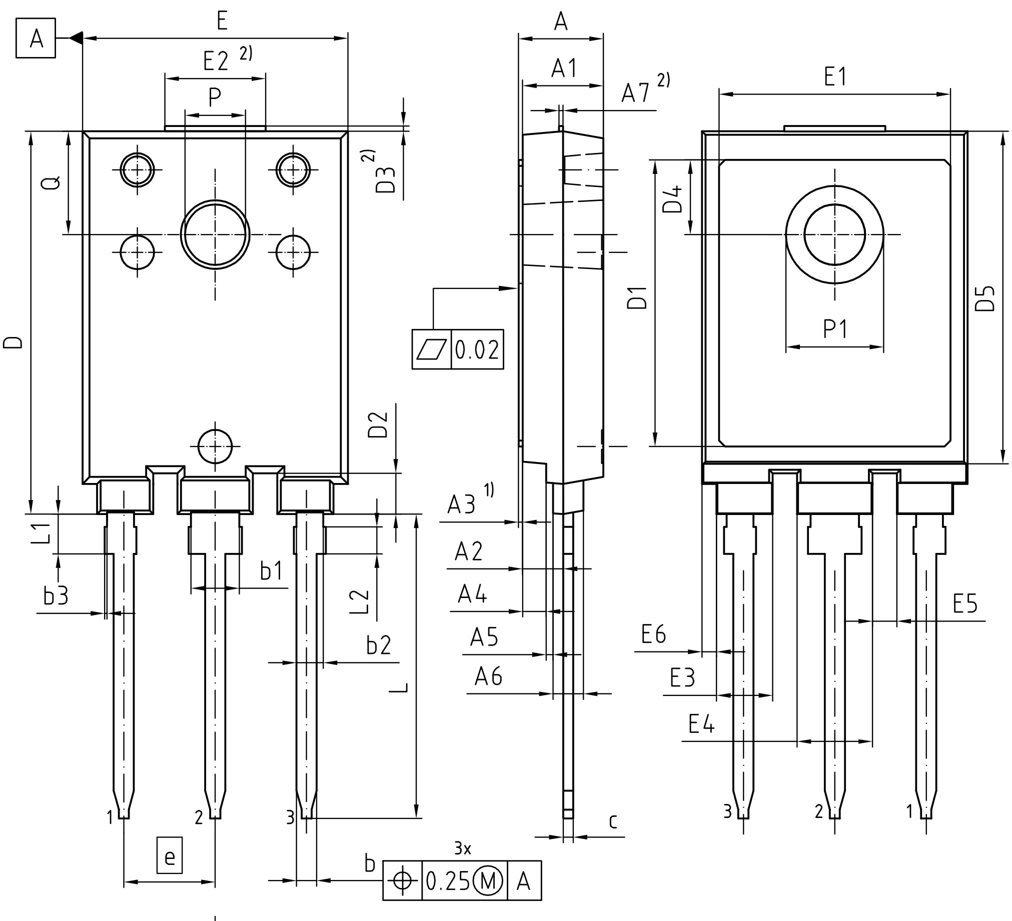
$I_F = f(V_F)$



Typical diode forward voltage per leg as a function of junction temperature $V_F = f(T_{vj})$	
	

4 Package outlines

PG-HSIP247-3-2



NOTES:
1) ABOVE ISOLATION LAYER DIMENSION IS UNDER NON-FORCE APPLIED CONDITION
2) MOLD GATE PROTRUSION AFTER DEGATING
ALL METAL SURFACES TIN PLATED EXCEPT AREA OF CUT

DIMENSIONS	MILLIMETERS MIN.	MILLIMETERS MAX.	DIMENSIONS	MILLIMETERS MIN.	MILLIMETERS MAX.
A	-	5.18	e	5.44	
A1	4.70	4.90	E	15.70	15.90
A2	2.16	2.66	E1	13.68	13.88
A3	0.20	0.28	E2	(6.00)	
A4	1.30	1.50	E3	3.24	3.44
A5	0.31	0.51	E4	4.39	4.59
A6	1.70	1.90	E5	(1.45)	
A7	(0.25)		E6	0.76	0.96
b	1.10	1.30	L	18.01	18.21
b1	(2.88)		L1	2.26	2.46
b2	(1.60)		L2	1.50	1.70
b3	-	0.15	P	3.50	3.70
c	0.50	0.70	P1	5.70	5.90
D	22.70	22.90	Q	6.06	6.26
D1	16.96	17.16			
D2	2.34	2.54			
D3	-	0.30			
D4	4.35	4.55			
D5	19.70	19.90			

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0 1 2 3 4 5 6 7 8mm

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Figure 1

5 Testing conditions

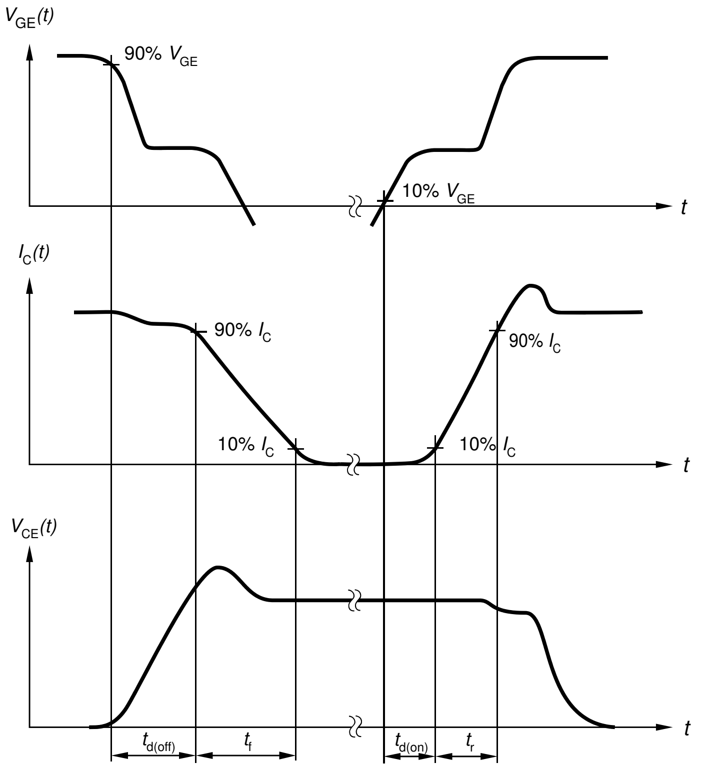

Figure A. **Definition of switching times**

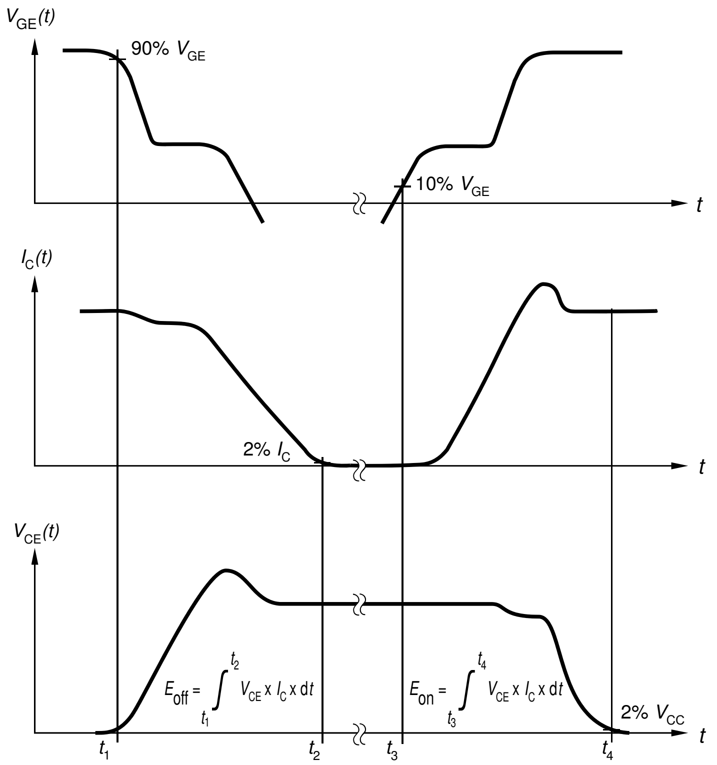

Figure B. **Definition of switching losses**

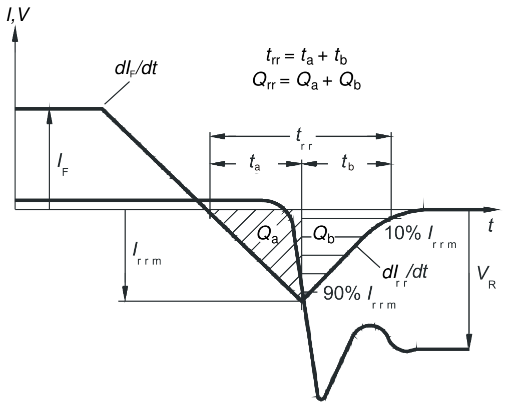

Figure C. **Definition of diode switching characteristics**

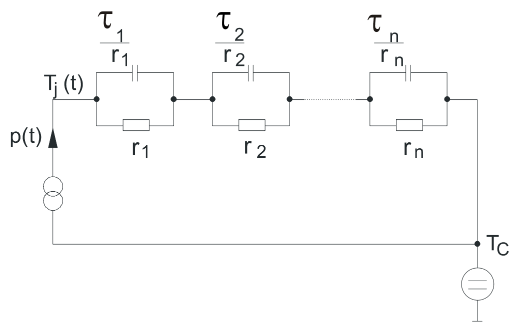

Figure D. **Thermal equivalent circuit**

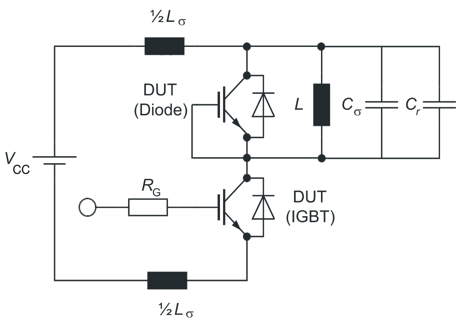

Figure E. **Dynamic test circuit**
Parasitic inductance L_{σ},
parasitic capacitor C_{σ},
relief capacitor C_{r},
(only for ZVT switching)

Figure 2

Revision history

Document revision	Date of release	Description of changes
V2.1	2020-07-09	Target datasheet
V2.2	2020-09-25	New marking description
n/a	2020-11-30	Datasheet migrated to a new system with a new layout and new revision number schema: target or preliminary datasheet = 0.xy; final datasheet = 1.xy
1.10	2022-06-24	Correction of package outline drawing on page 8

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