

Reverse-Conducting IGBT with monolithic body diode

Features

- $V_{CE} = 1400\text{ V}$
- $I_C = 20\text{ A}$
- Powerful monolithic body diode with low forward voltage designed for soft commutation only
- Very tight parameter distribution
- High ruggedness, temperature stable behavior
- Very low V_{CEsat}
- Easy paralleling capability due to positive temperature coefficient in V_{CEsat}
- Low EMI
- Qualified according to JESD-022 for target applications
- Pb-free lead plating; RoHS compliant
- Halogen free (according to IEC 61249-2-21)
- Complete product spectrum and PSpice Models: <http://www.infineon.com/igbt/>

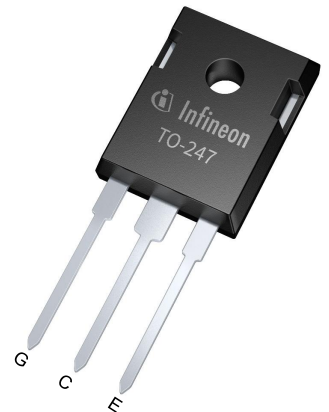
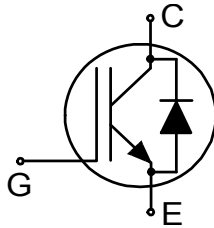
Potential applications

- Induction cooker
- Microwave ovens

Product validation

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

Description



Type	Package	Marking
IHW20N140R5L	PG-TO247-3-STD-NN2.5	H20QR5L

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1 Package

Table 1 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Internal emitter inductance measured 5 mm (0.197 in.) from case	L_E			13		nH
Storage temperature	T_{stg}		-55		150	°C
Soldering temperature	T_{sold}	wave soldering 1.6 mm (0.063 in.) from case for 10 s			260	°C
Mounting torque	M	M3 screw, Maximum of mounting processes: 3			0.6	Nm
Thermal resistance, junction-ambient	$R_{th(j-a)}$				40	K/W
IGBT thermal resistance, junction-case	$R_{th(j-c)}$				0.71	K/W
Diode thermal resistance, junction-case	$R_{th(j-c)}$				0.71	K/W

2 IGBT

Table 2 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit	
Collector-emitter voltage	V_{CE}	$T_{vj} \geq 25 \text{ °C}$	1400	V	
DC collector current, limited by T_{vjmax}	I_C	limited by bondwire	$T_c = 25 \text{ °C}$	40	A
			$T_c = 100 \text{ °C}$	38	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}		60	A	
Non repetitive peak collector current ¹⁾	I_{CSM}		200	A	
Turn-off safe operating area ²⁾		$V_{CE} \leq 1400 \text{ V}, T_{vj} \leq 175 \text{ °C}$	60	A	
Gate-emitter voltage	V_{GE}		±20	V	
Transient gate-emitter voltage	V_{GE}	$t_p \leq 10 \text{ } \mu\text{s}, D < 0.01$	±25	V	
Power dissipation	P_{tot}		$T_c = 25 \text{ °C}$	211	W
			$T_c = 100 \text{ °C}$	106	

1) capacitor charging saturation current limited by $T_{vjmax} < 175 \text{ °C}$ and $t_p < 3 \text{ } \mu\text{s}$

2) $dV/dt < 1 \text{ kV}/\mu\text{s}$

Table 3 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter breakdown voltage	V_{BRCES}	$I_C = 0.5 \text{ mA}, V_{GE} = 0 \text{ V}$	1400			V
Collector-emitter saturation voltage	V_{CESat}	$I_C = 20 \text{ A}, V_{GE} = 15 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	1.7	1.9	V
			$T_{vj} = 125 \text{ }^\circ\text{C}$	1.9		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	2		
Collector-emitter saturation voltage	V_{CESat}	$I_C = 15 \text{ A}, V_{GE} = 15 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	1.55	1.75	V
			$T_{vj} = 125 \text{ }^\circ\text{C}$	1.7		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	1.75		
Gate-emitter threshold voltage	V_{GETh}	$I_C = 0.28 \text{ mA}, V_{CE} = V_{GE}$	4	5.6	6.2	V
Zero gate-voltage collector current	I_{CES}	$V_{CE} = 1400 \text{ V}, V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$		100	μA
			$T_{vj} = 175 \text{ }^\circ\text{C}$		460	
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = 20 \text{ V}$			100	nA
Transconductance	g_{fs}	$I_C = 20 \text{ A}, V_{CE} = 20 \text{ V}$		17.8		S
Input capacitance	C_{ies}	$V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}, f = 100 \text{ kHz}$		870		pF
Output capacitance	C_{oes}	$V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}, f = 100 \text{ kHz}$		28		pF
Reverse transfer capacitance	C_{res}	$V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}, f = 100 \text{ kHz}$		22		pF
Gate charge	Q_G	$V_{CC} = 1120 \text{ V}, I_C = 20 \text{ A}, V_{GE} = 15 \text{ V}$		125		nC
Turn-off delay time	$t_{d(off)}$	$V_{GE} = 0/15 \text{ V}, R_{G(off)} = 10 \text{ } \Omega, C_r = 270 \text{ nF}, L = 77 \text{ } \mu\text{H}, R = 2.2 \text{ } \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}, I_C = 20 \text{ A}$	150		ns
			$T_{vj} = 175 \text{ }^\circ\text{C}, I_C = 20 \text{ A}$	160		
Fall time (inductive load)	t_f	$V_{GE} = 0/15 \text{ V}, R_{G(off)} = 10 \text{ } \Omega, C_r = 270 \text{ nF}, L = 77 \text{ } \mu\text{H}, R = 2.2 \text{ } \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}, I_C = 20 \text{ A}$	1090		ns
			$T_{vj} = 175 \text{ }^\circ\text{C}, I_C = 20 \text{ A}$	1890		
Soft turn-off energy	E_{off}	$V_{GE} = 0/15 \text{ V}, R_{G(off)} = 10 \text{ } \Omega, C_r = 270 \text{ nF}, L = 77 \text{ } \mu\text{H}, R = 2.2 \text{ } \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}, I_C = 20 \text{ A}$	0.07		mJ
			$T_{vj} = 175 \text{ }^\circ\text{C}, I_C = 20 \text{ A}$	0.17		
Operating junction temperature	T_{vj}		-40		175	$^\circ\text{C}$

3 Diode

Table 4 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit	
Diode forward current, limited by T_{vjmax}	I_F	limited by bondwire	$T_c = 25\text{ °C}$	40	A
			$T_c = 100\text{ °C}$	40	
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpulse}		60	A	

Table 5 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Diode forward voltage	V_F	$I_F = 20\text{ A}$	$T_{vj} = 25\text{ °C}$	1.6	1.9	V
			$T_{vj} = 125\text{ °C}$	1.8		
			$T_{vj} = 175\text{ °C}$	1.85		
Diode forward voltage	V_F	$I_F = 15\text{ A}$	$T_{vj} = 25\text{ °C}$	1.5	1.8	V
			$T_{vj} = 125\text{ °C}$	1.6		
			$T_{vj} = 175\text{ °C}$	1.65		
Operating junction temperature	T_{vj}		-40		175	°C

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

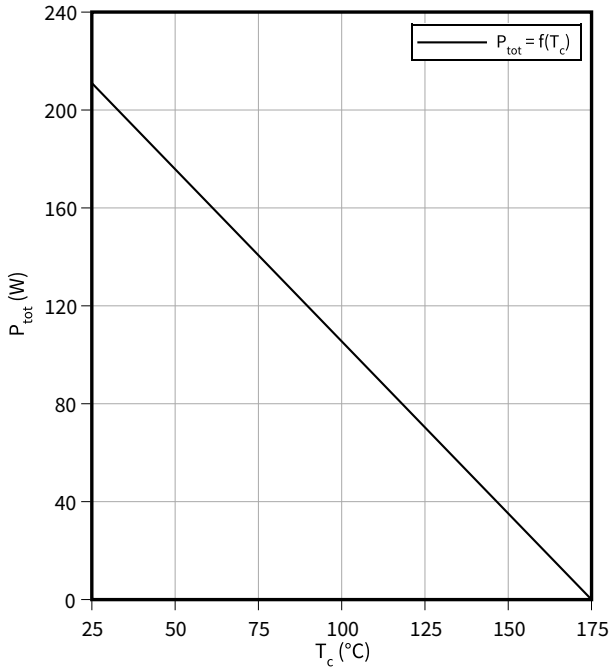
Electrical Characteristic, at $T_{vj} = 25\text{ °C}$, unless otherwise specified.

Dynamic test circuit, energy losses include “tail” according to Figure B. (Test circuit Figure E).

4 Characteristics diagrams

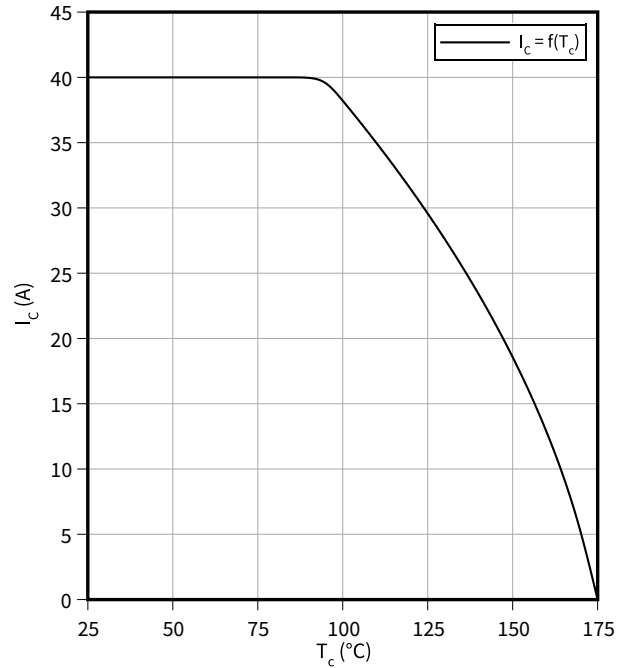
Power dissipation as a function of case temperature

$P_{\text{tot}} = f(T_c)$
 $T_{\text{vj}} \leq 175 \text{ }^\circ\text{C}$



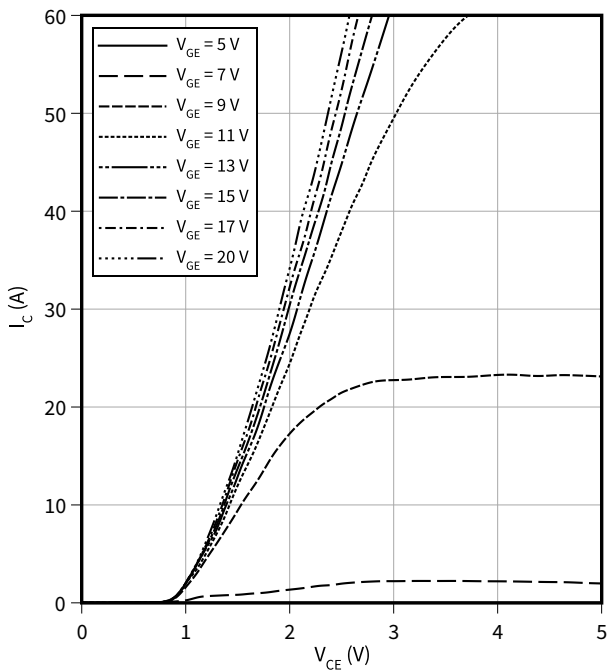
Collector current as a function of case temperature

$I_C = f(T_c)$
 $T_{\text{vj}} \leq 175 \text{ }^\circ\text{C}, V_{\text{GE}} \geq 15 \text{ V}$



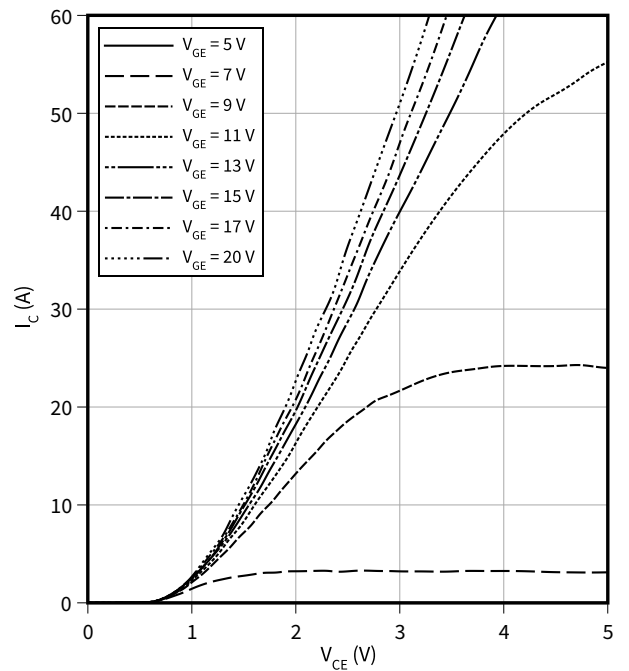
Typical output characteristic

$I_C = f(V_{\text{CE}})$
 $T_{\text{vj}} = 25 \text{ }^\circ\text{C}$



Typical output characteristic

$I_C = f(V_{\text{CE}})$
 $T_{\text{vj}} = 175 \text{ }^\circ\text{C}$

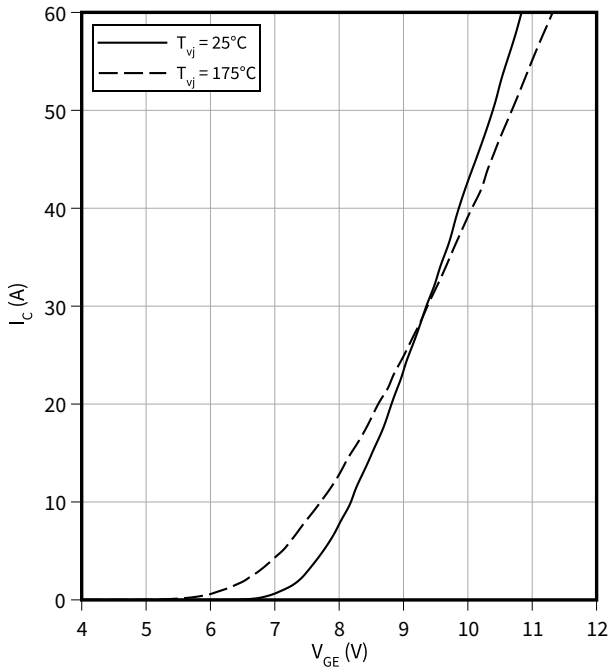


4 Characteristics diagrams

Typical transfer characteristic

$$I_C = f(V_{GE})$$

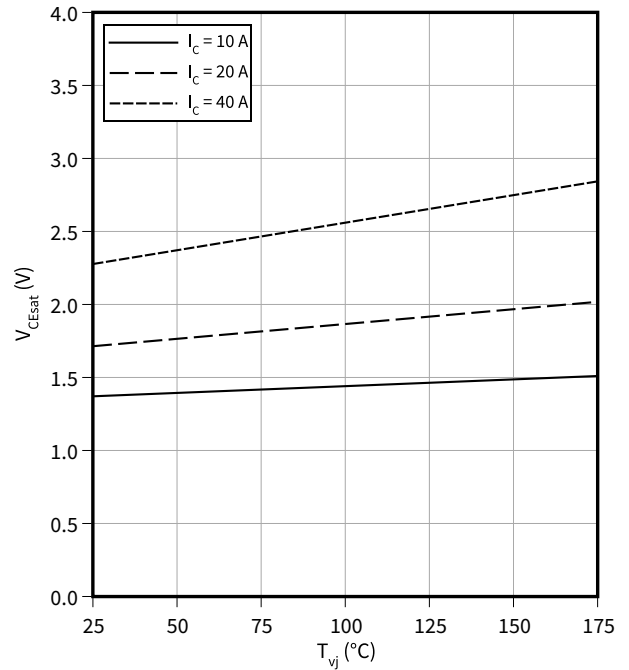
$$V_{CE} = 20 \text{ V}$$



Typical collector-emitter saturation voltage as a function of junction temperature

$$V_{CEsat} = f(T_{vj})$$

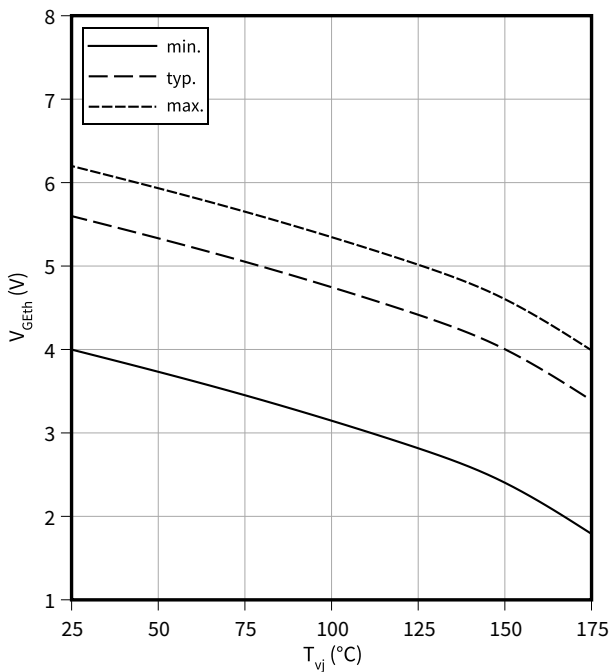
$$V_{GE} = 15 \text{ V}$$



Gate-emitter threshold voltage as a function of junction temperature

$$V_{GEth} = f(T_{vj})$$

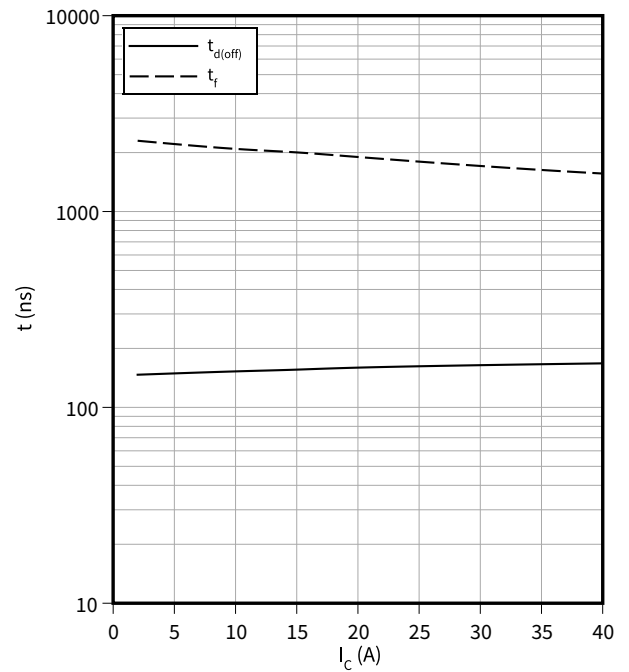
$$I_C = 0.28 \text{ mA}$$



Typical switching times as a function of collector current

$$t = f(I_C)$$

$$T_{vj} = 175 \text{ °C}, V_{GE} = 0/15 \text{ V}, C_r = 270 \text{ nF}, R_G = 10 \text{ } \Omega$$

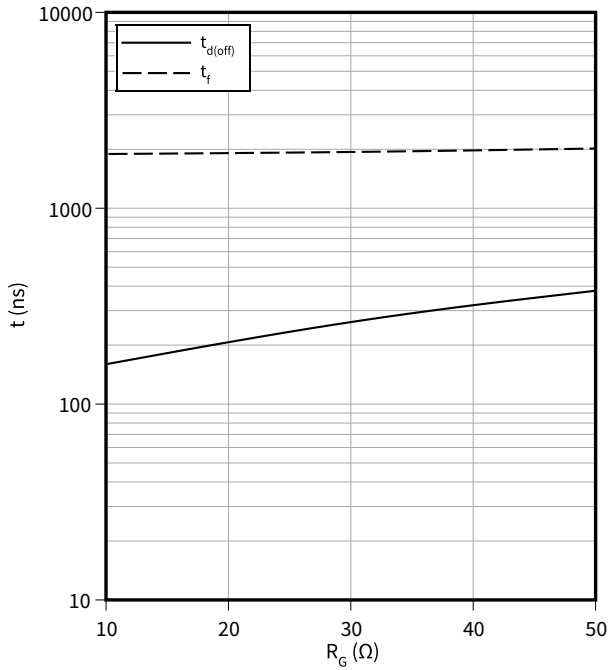


4 Characteristics diagrams

Typical switching times as a function of gate resistor

$t = f(R_G)$

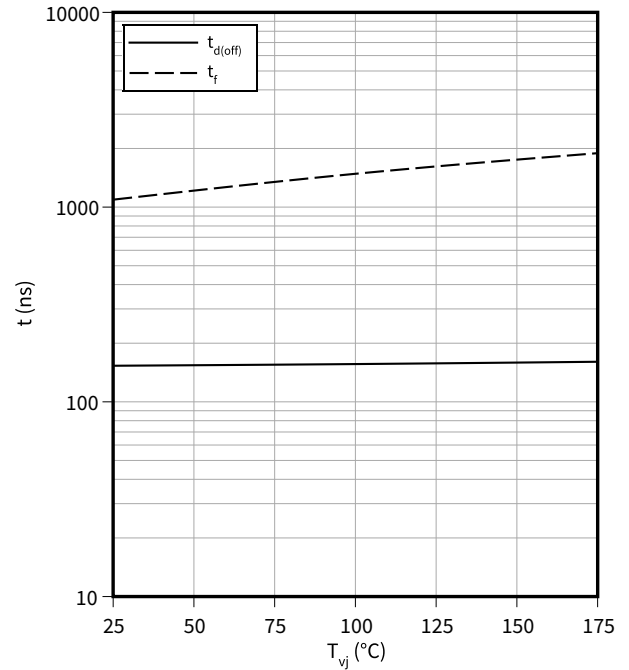
$I_C = 20 \text{ A}$, $T_{vj} = 175 \text{ }^\circ\text{C}$, $V_{GE} = 0/15 \text{ V}$, $C_r = 270 \text{ nF}$



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

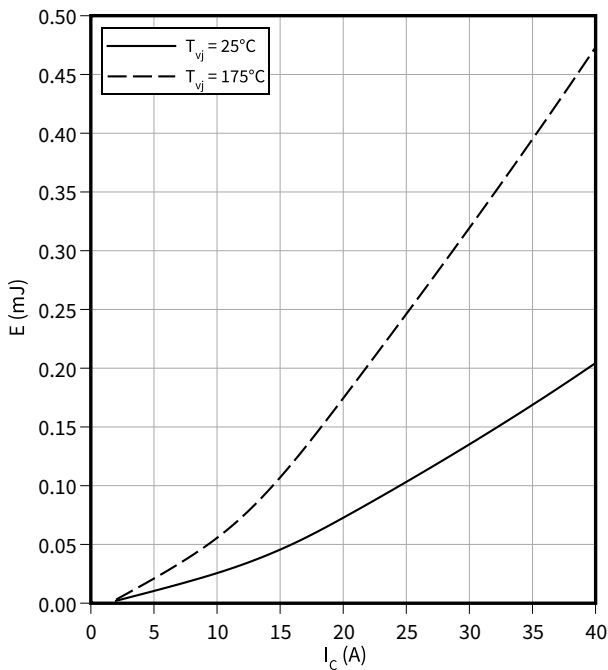
$I_C = 20 \text{ A}$, $V_{GE} = 0/15 \text{ V}$, $C_r = 270 \text{ nF}$, $R_G = 10 \text{ } \Omega$



Typical switching energy losses as a function of collector current

$E = f(I_C)$

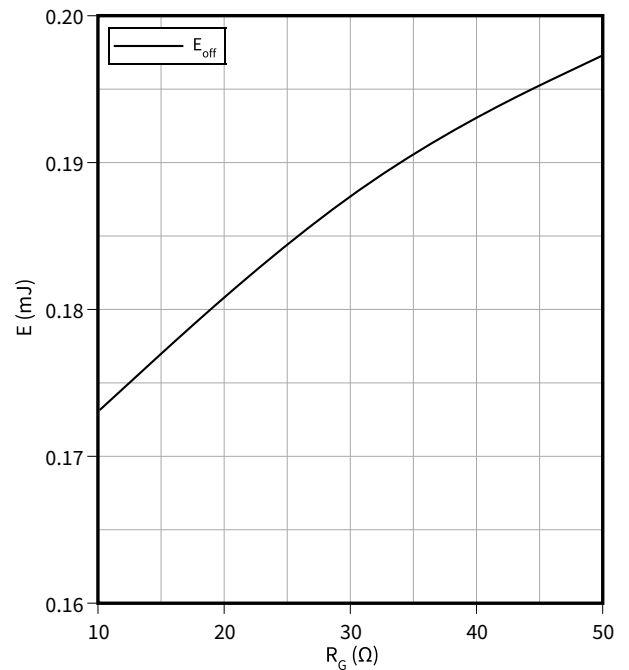
$V_{GE} = 0/15 \text{ V}$, $C_r = 270 \text{ nF}$, $R_G = 10 \text{ } \Omega$



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

$I_C = 20 \text{ A}$, $T_{vj} = 175 \text{ }^\circ\text{C}$, $V_{GE} = 0/15 \text{ V}$, $C_r = 270 \text{ nF}$

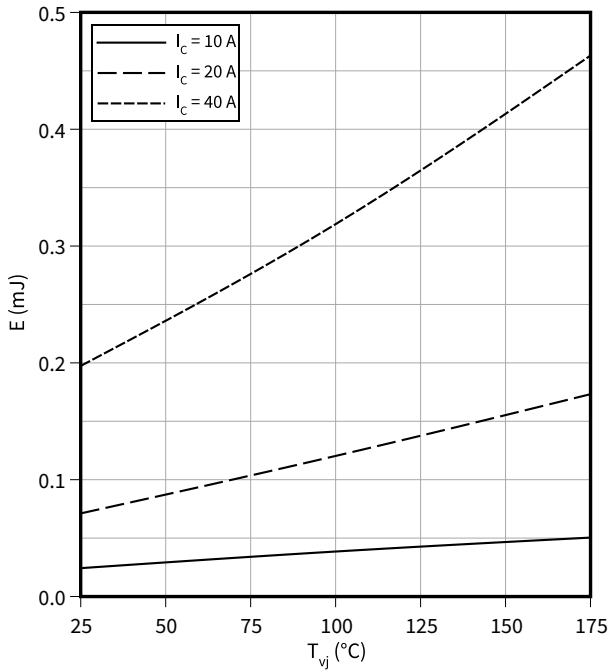


4 Characteristics diagrams

Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

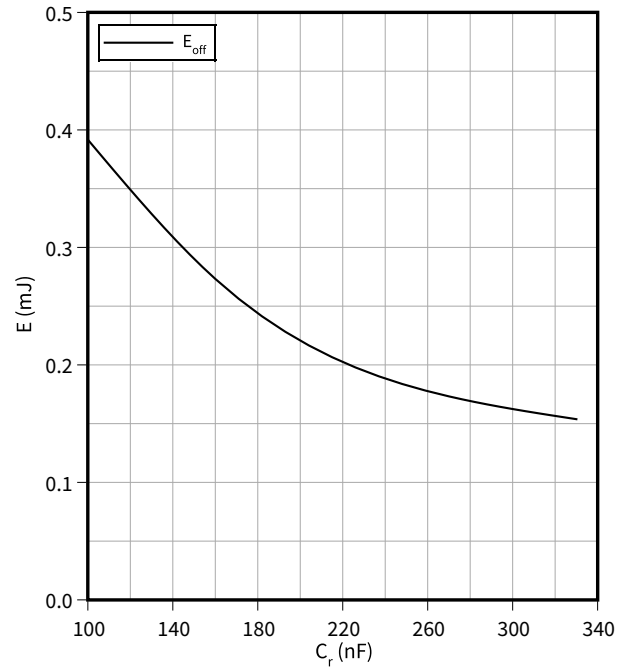
$V_{GE} = 0/15\text{ V}$, $C_r = 270\text{ nF}$, $R_G = 10\ \Omega$



Typical switching energy losses as a function of resonant capacitance

$E = f(C_r)$

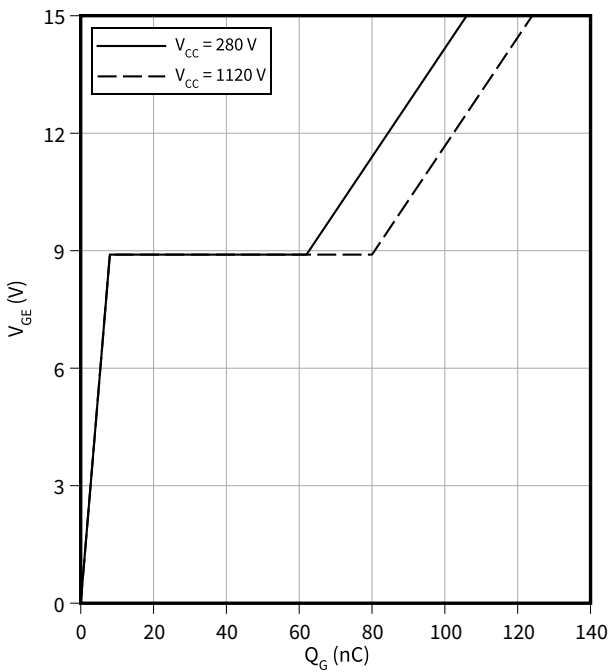
$I_C = 20\text{ A}$, $T_{vj} = 175\text{ °C}$, $V_{GE} = 0/15\text{ V}$, $R_G = 10\ \Omega$



Typical gate charge

$V_{GE} = f(Q_G)$

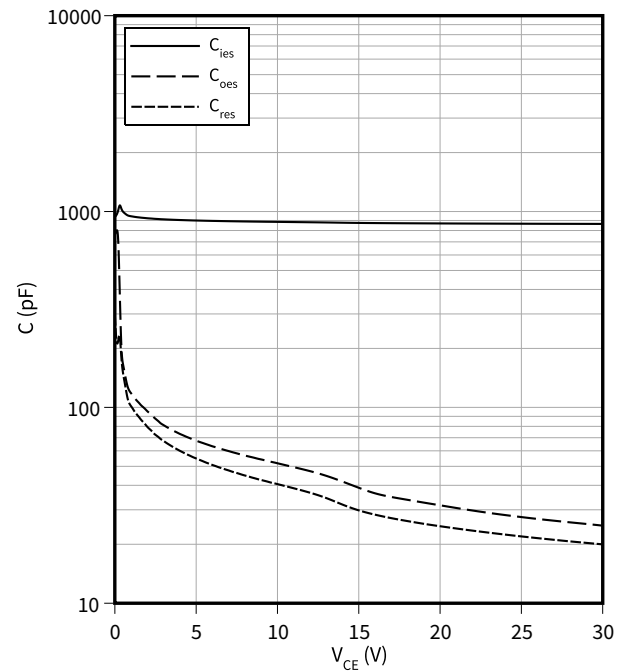
$I_C = 20\text{ A}$



Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE})$

$f = 100\text{ kHz}$, $V_{GE} = 0\text{ V}$

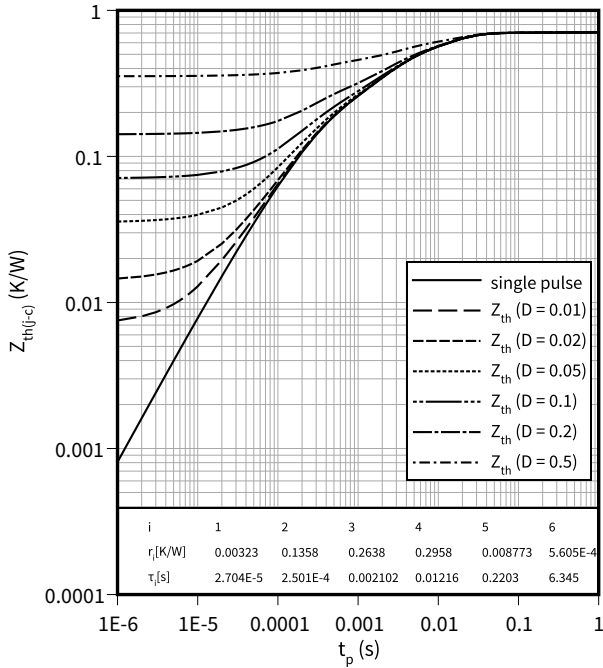


4 Characteristics diagrams

IGBT transient thermal impedance as a function of pulse width

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

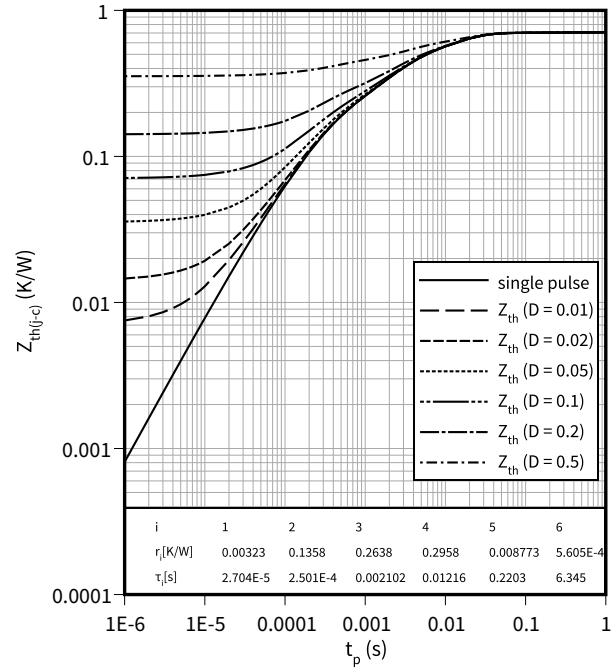
$$D = t_p/T$$



Diode transient thermal impedance as a function of pulse width

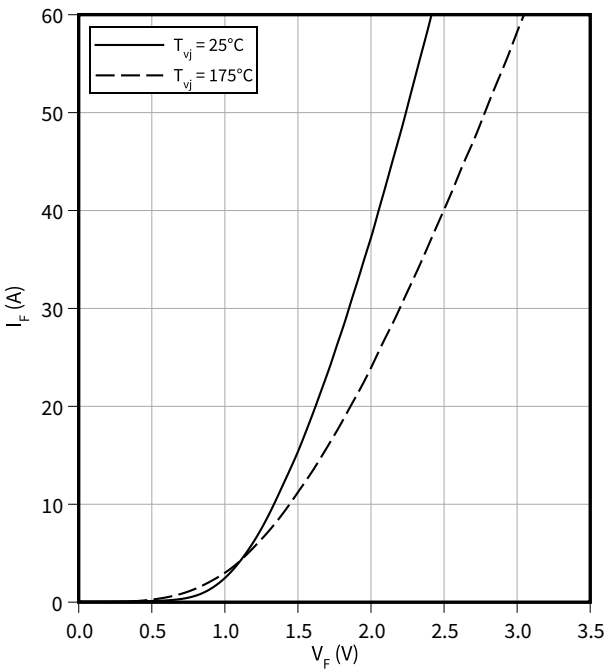
$$Z_{th(j-c)} = f(t_p)$$

$$D = t_p/T$$



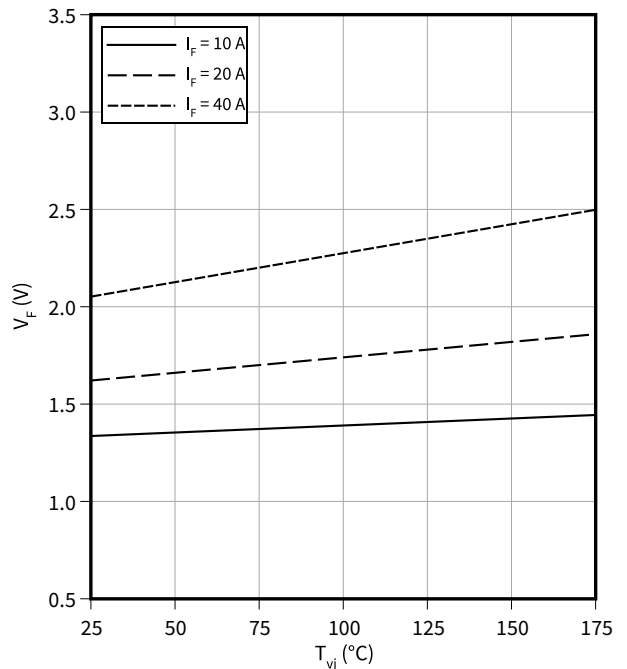
Typical diode forward current as a function of forward voltage

$$I_F = f(V_F)$$



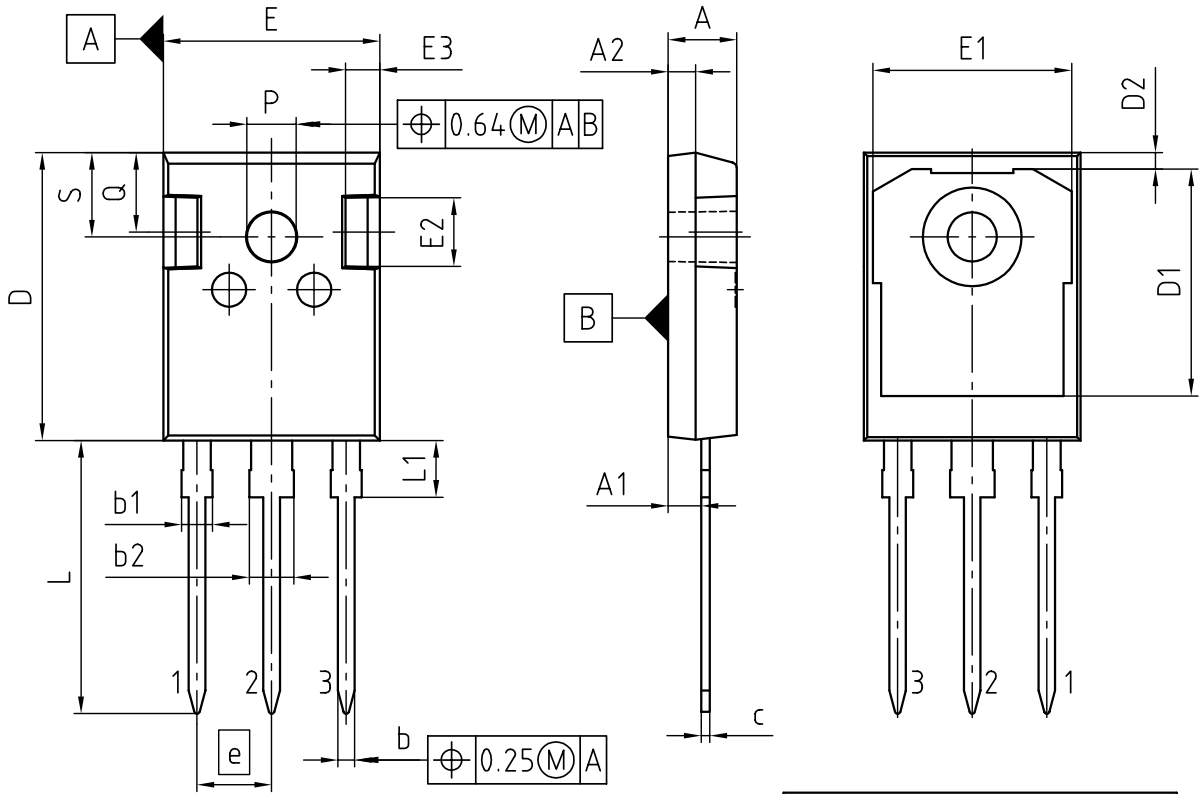
Typical diode forward voltage as a function of junction temperature

$$V_F = f(T_{vj})$$



5 Package outlines

PG-TO247-3-STD-NN2.5



PACKAGE - GROUP NUMBER: PG-TO247-3-U06		
DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	4.83	5.21
A1	2.27	2.54
A2	1.85	2.16
b	1.07	1.33
b1	1.90	2.41
b2	2.87	3.38
c	0.55	0.68
D	20.80	21.10
D1	16.25	17.65
D2	0.95	1.35
E	15.70	16.13
E1	13.10	14.15
E2	3.68	5.10
E3	1.00	2.60
e	5.44	
N	3	
L	19.80	20.32
L1	4.10	4.47
ϕP	3.50	3.70
Q	5.49	6.00
S	6.04	6.30

NOTE:
DIMENSIONS DO NOT INCLUDE MOLDFLASH; PROTRUSION OR GATE BURRS

Figure 1

6 Testing conditions

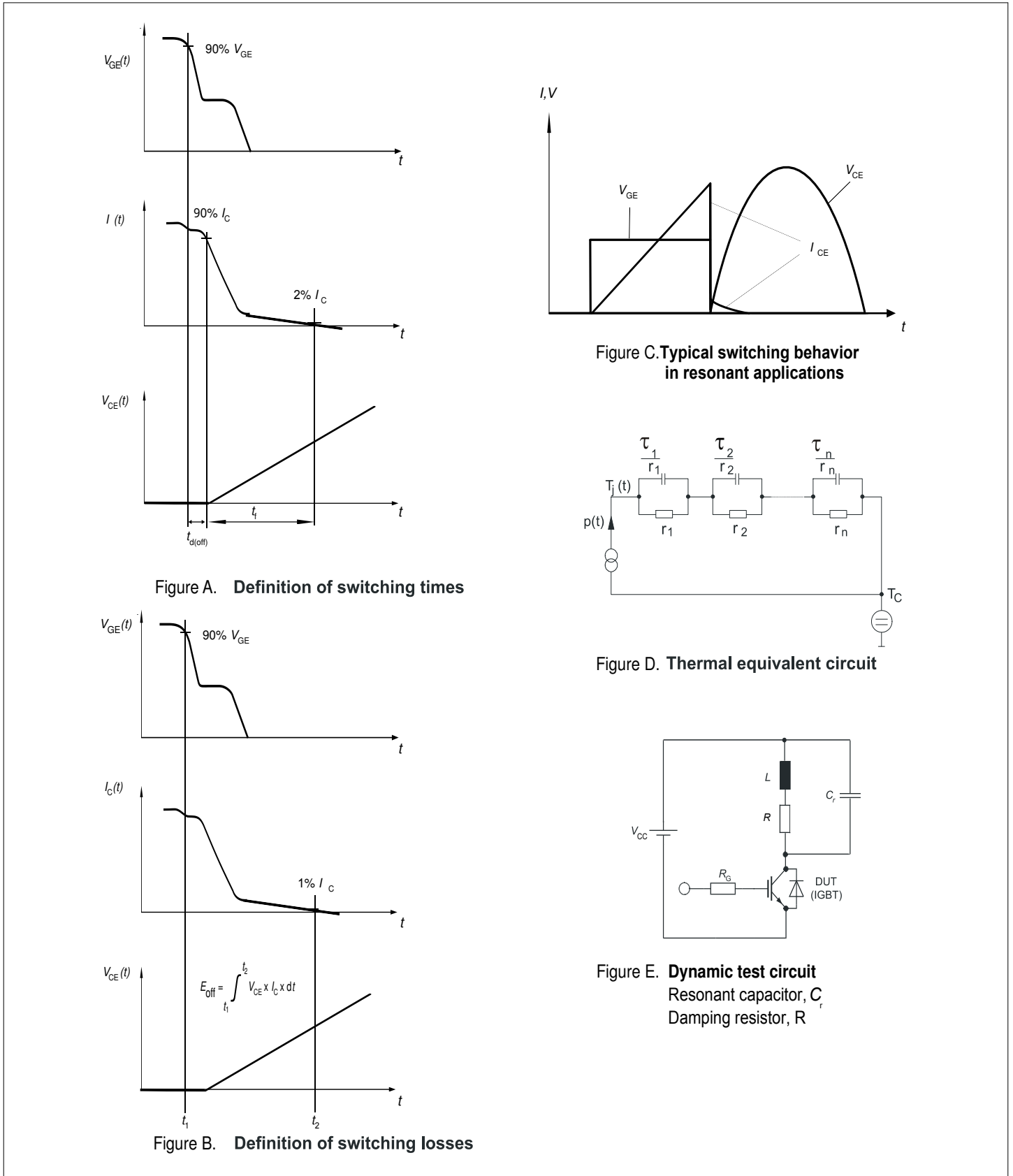


Figure 2

Revision history

Document revision	Date of release	Description of changes
0.10	2022-11-25	Preliminary datasheet
1.00	2023-05-19	Final datasheet

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