

Final datasheet

High speed and low saturation voltage 650 V TRENCHSTOP™ IGBT7 technology copacked with soft, fast recovery Emitter Controlled 7 diode

Features

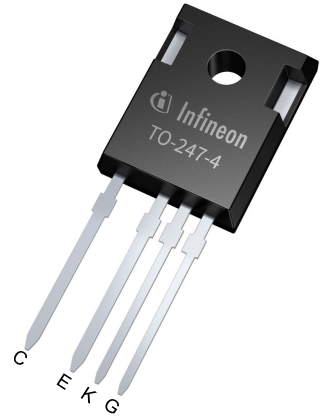
- $V_{CE} = 650\text{ V}$
- $I_C = 50\text{ A}$
- Low switching losses
- Very low collector-emitter saturation voltage V_{CEsat}
- Very soft, fast recovery antiparallel diode
- Smooth switching behavior
- Humidity robustness
- Optimized for hard switching, two- and three-level topologies
- Complete product spectrum and PSpice Models: <http://www.infineon.com/igbt/>

Potential applications

- Industrial UPS
- EV-Charging
- String inverter
- Welding

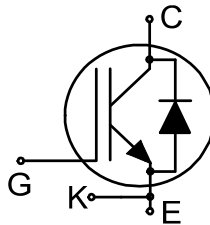
Product validation

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



- Lead-free
- Green
- Halogen-free
- RoHS

Description



Type	Package	Marking
IKZA50N65EH7	PG-TO247-4-STD-NT3.7	K50EEH7

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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	$R_{th(j-c)}$			0.46	0.6	K/W
Diode thermal resistance, junction-case	$R_{th(j-c)}$			0.61	0.8	K/W

2 IGBT

Table 2 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit	
Collector-emitter voltage	V_{CE}	$T_{vj} \geq 25 \text{ °C}$	650	V	
DC collector current, limited by T_{vjmax}	I_C	limited by bondwire	$T_c = 25 \text{ °C}$	80	A
			$T_c = 100 \text{ °C}$	76	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}		200	A	
Turn-off safe operating area		$V_{CE} \leq 650 \text{ V}, t_p \leq 1 \text{ }\mu\text{s}, T_{vj} \leq 175 \text{ °C}$	200	A	
Gate-emitter voltage	V_{GE}		± 20	V	
Transient gate-emitter voltage	V_{GE}	$t_p \leq 10 \text{ }\mu\text{s}, D < 0.01$	± 30	V	
Power dissipation	P_{tot}		$T_c = 25 \text{ °C}$	250	W
			$T_c = 100 \text{ °C}$	124	

Table 3 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	V_{CEsat}	$I_C = 50\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25\text{ °C}$		1.4	1.65	V
			$T_{vj} = 175\text{ °C}$		1.6		
Gate-emitter threshold voltage	V_{GEth}	$I_C = 0.44\text{ mA}, V_{CE} = V_{GE}$		2.9	3.85	4.8	V
Zero gate-voltage collector current	I_{CES}	$V_{CE} = 650\text{ V}, V_{GE} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$			15	μA
			$T_{vj} = 175\text{ °C}$		1500		
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\text{ V}, V_{GE} = 20\text{ V}$				100	nA
Transconductance	g_{fs}	$I_C = 50\text{ A}, V_{CE} = 20\text{ V}$			79		S
Input capacitance	C_{ies}	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$			2591		pF
Output capacitance	C_{oes}	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$			87.1		pF
Reverse transfer capacitance	C_{res}	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$			11.4		pF
Gate charge	Q_G	$V_{CC} = 520\text{ V}, I_C = 50\text{ A}, V_{GE} = 15\text{ V}$			103		nC
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 400\text{ V}, V_{GE} = 0/15\text{ V}, R_{G(on)} = 10\ \Omega, R_{G(off)} = 10\ \Omega$	$T_{vj} = 25\text{ °C}, I_C = 50\text{ A}$		15		ns
			$T_{vj} = 175\text{ °C}, I_C = 50\text{ A}$		14		
Rise time (inductive load)	t_r	$V_{CC} = 400\text{ V}, V_{GE} = 0/15\text{ V}, R_{G(on)} = 10\ \Omega, R_{G(off)} = 10\ \Omega$	$T_{vj} = 25\text{ °C}, I_C = 50\text{ A}$		9		ns
			$T_{vj} = 175\text{ °C}, I_C = 50\text{ A}$		12		
Turn-off delay time	$t_{d(off)}$	$V_{CC} = 400\text{ V}, V_{GE} = 0/15\text{ V}, R_{G(on)} = 10\ \Omega, R_{G(off)} = 10\ \Omega$	$T_{vj} = 25\text{ °C}, I_C = 50\text{ A}$		142		ns
			$T_{vj} = 175\text{ °C}, I_C = 50\text{ A}$		175		
Fall time (inductive load)	t_f	$V_{CC} = 400\text{ V}, V_{GE} = 0/15\text{ V}, R_{G(on)} = 10\ \Omega, R_{G(off)} = 10\ \Omega$	$T_{vj} = 25\text{ °C}, I_C = 50\text{ A}$		14		ns
			$T_{vj} = 175\text{ °C}, I_C = 50\text{ A}$		18		
Turn-on energy	E_{on}	$V_{CC} = 400\text{ V}, V_{GE} = 0/15\text{ V}, R_{G(on)} = 10\ \Omega, R_{G(off)} = 10\ \Omega$	$T_{vj} = 25\text{ °C}, I_C = 50\text{ A}$		0.44		mJ
			$T_{vj} = 175\text{ °C}, I_C = 50\text{ A}$		0.79		

(table continues...)

Table 3 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Turn-off energy	E_{off}	$V_{CC} = 400\text{ V}, V_{GE} = 0/15\text{ V},$ $R_{G(on)} = 10\ \Omega,$ $R_{G(off)} = 10\ \Omega$	$T_{vj} = 25\text{ }^\circ\text{C},$ $I_C = 50\text{ A}$		0.49	mJ
			$T_{vj} = 175\text{ }^\circ\text{C},$ $I_C = 50\text{ A}$		0.97	
Total switching energy	E_{ts}	$V_{CC} = 400\text{ V}, V_{GE} = 0/15\text{ V},$ $R_{G(on)} = 10\ \Omega,$ $R_{G(off)} = 10\ \Omega$	$T_{vj} = 25\text{ }^\circ\text{C},$ $I_C = 50\text{ A}$		0.93	mJ
			$T_{vj} = 175\text{ }^\circ\text{C},$ $I_C = 50\text{ A}$		1.76	
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	$T_c = 25\text{ }^\circ\text{C}$	80	A
			$T_c = 100\text{ }^\circ\text{C}$	59	
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpulse}		200	A	
Power dissipation	P_{tot}		$T_c = 25\text{ }^\circ\text{C}$	186	W
			$T_c = 100\text{ }^\circ\text{C}$	94	

Table 5 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Diode forward voltage	V_F	$I_F = 50\text{ A}$	$T_{vj} = 25\text{ }^\circ\text{C}$		1.65	V
			$T_{vj} = 175\text{ }^\circ\text{C}$		1.55	
Diode reverse recovery time	t_{rr}	$V_R = 400\text{ V}, R_{G(on)} = 10\ \Omega$	$T_{vj} = 25\text{ }^\circ\text{C},$ $I_F = 50\text{ A}$		54.6	ns
			$T_{vj} = 175\text{ }^\circ\text{C},$ $I_F = 50\text{ A}$		86.4	
Diode reverse recovery charge	Q_{rr}	$V_R = 400\text{ V}, R_{G(on)} = 10\ \Omega$	$T_{vj} = 25\text{ }^\circ\text{C},$ $I_F = 50\text{ A}$		1.28	μC
			$T_{vj} = 175\text{ }^\circ\text{C},$ $I_F = 50\text{ A}$		3.4	

(table continues...)

Table 5 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Diode peak reverse recovery current	I_{rrm}	$V_R = 400\text{ V}, R_{G(on)} = 10\ \Omega$	$T_{vj} = 25\text{ °C}, I_F = 50\text{ A}$		43.3	A
			$T_{vj} = 175\text{ °C}, I_F = 50\text{ A}$		75.9	
Diode peak rate of fall of reverse recovery current	di_{rr}/dt	$V_R = 400\text{ V}, R_{G(on)} = 10\ \Omega$	$T_{vj} = 25\text{ °C}, I_F = 50\text{ A}$		-1240	A/ μs
			$T_{vj} = 175\text{ °C}, I_F = 50\text{ A}$		-1670	
Reverse recovery energy	E_{rec}	$V_R = 400\text{ V}, R_{G(on)} = 10\ \Omega$	$T_{vj} = 25\text{ °C}, I_F = 50\text{ A}$		0.36	mJ
			$T_{vj} = 175\text{ °C}, I_F = 50\text{ A}$		0.97	
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.

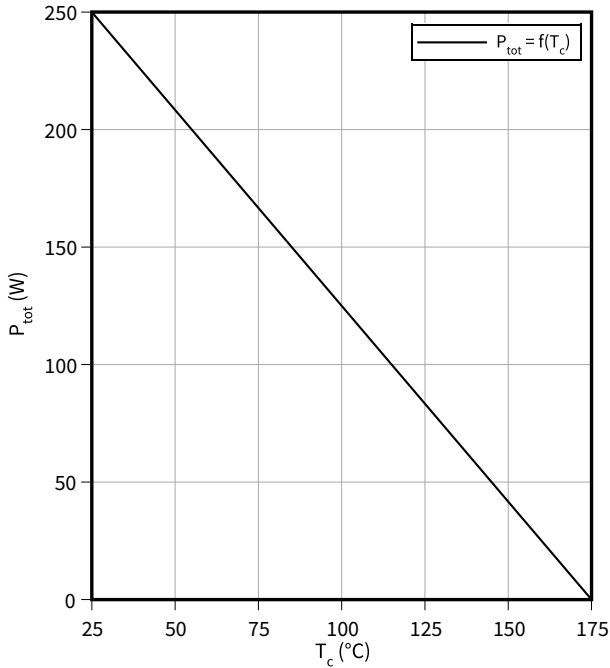
Electrical Characteristic, at $T_{vj} = 25\text{ °C}$, unless otherwise specified.

Dynamic test circuit, parasitic inductance $L_\sigma = 8\text{ nH}$, parasitic capacitor $C_\sigma = 30\text{ pF}$ from Fig. E. Energy losses include “tail” and diode reverse recovery.

4 Characteristics diagrams

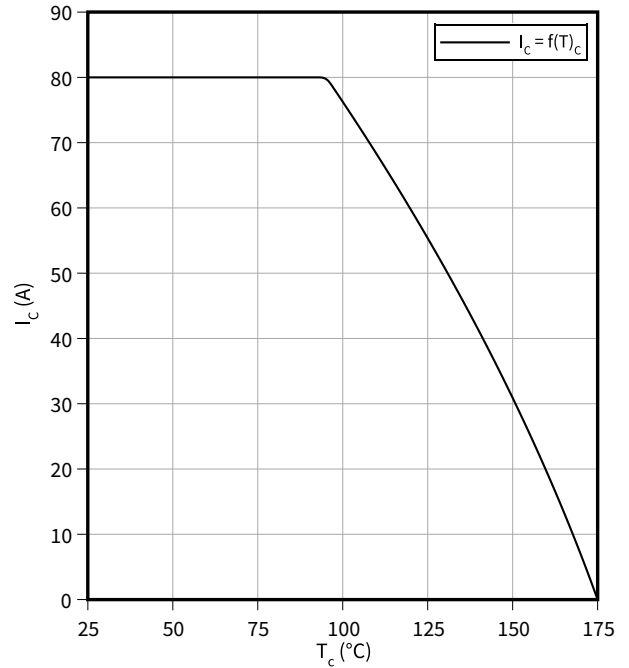
Power dissipation as a function of case temperature

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



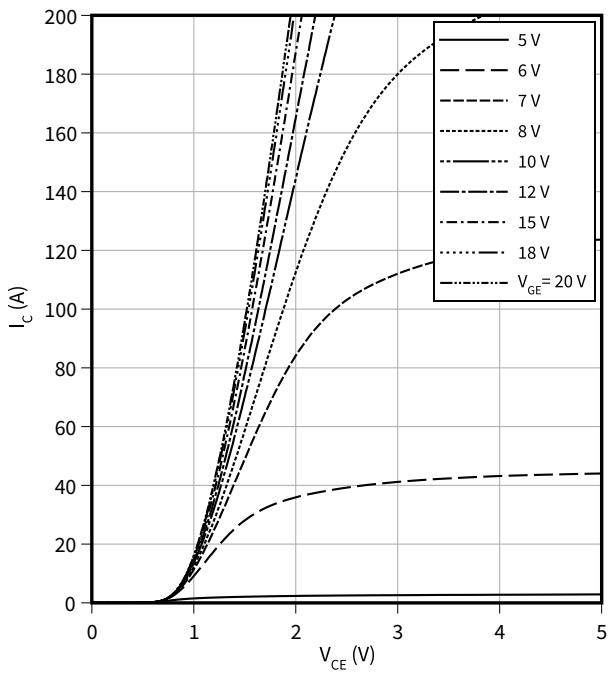
Collector current as a function of case temperature

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



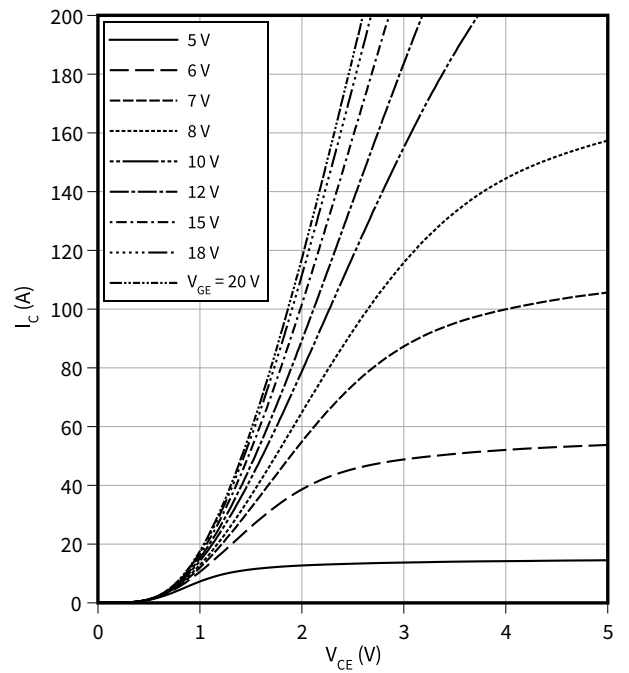
Typical output characteristic

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



Typical output characteristic

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

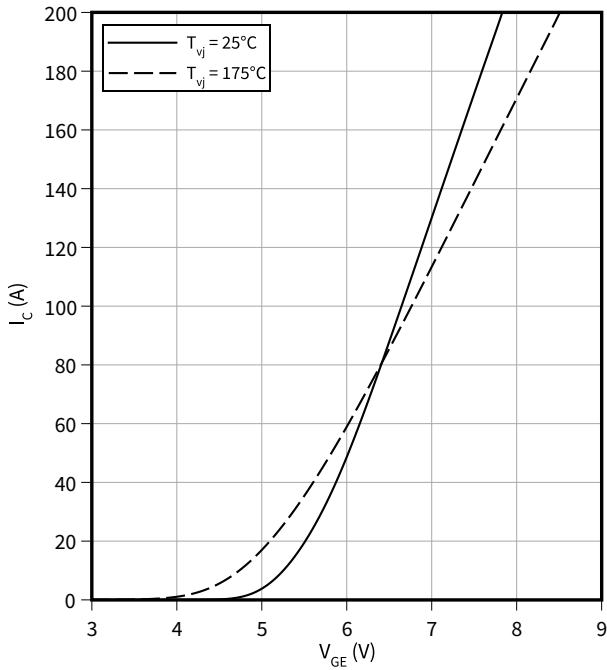


4 Characteristics diagrams

Typical transfer characteristic

$I_C = f(V_{GE})$

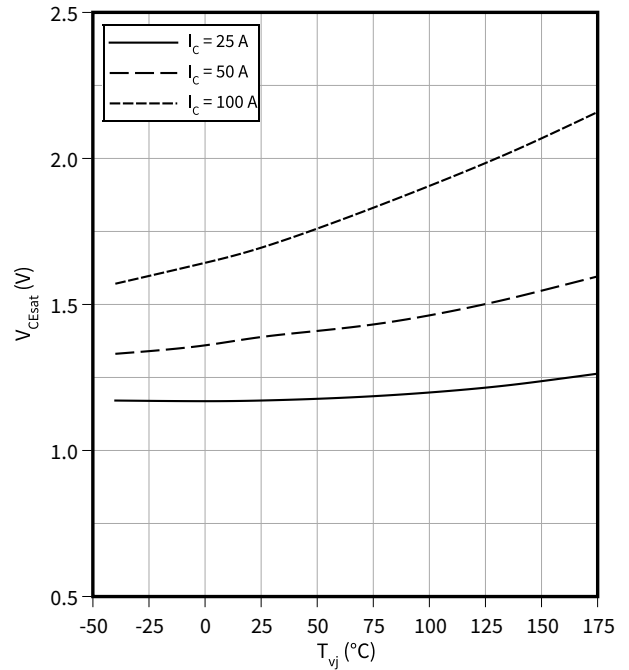
$V_{CE} = 20\text{ V}$



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

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

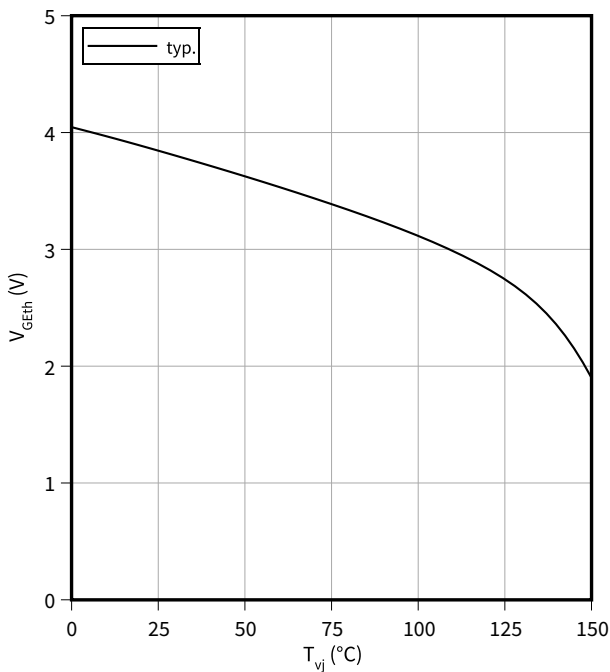
$V_{GE} = 15\text{ V}$



Gate-emitter threshold voltage as a function of junction temperature

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

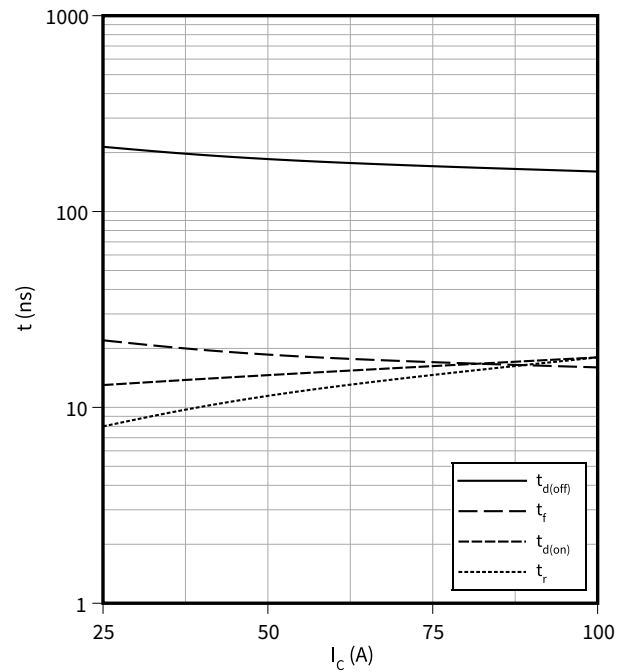
$I_C = 0.44\text{ mA}$



Typical switching times as a function of collector current

$t = f(I_C)$

$V_{CC} = 400\text{ V}, T_{vj} = 175^\circ\text{C}, V_{GE} = 0/15\text{ V}, R_G = 10\ \Omega$

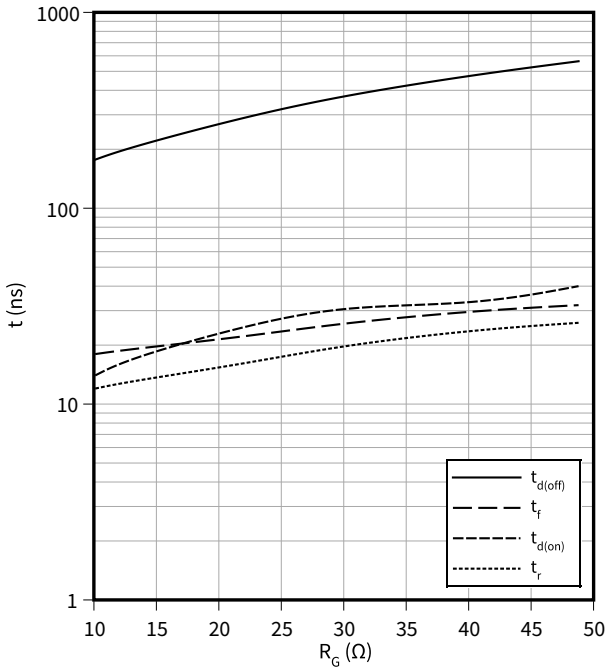


4 Characteristics diagrams

Typical switching times as a function of gate resistor

$t = f(R_G)$

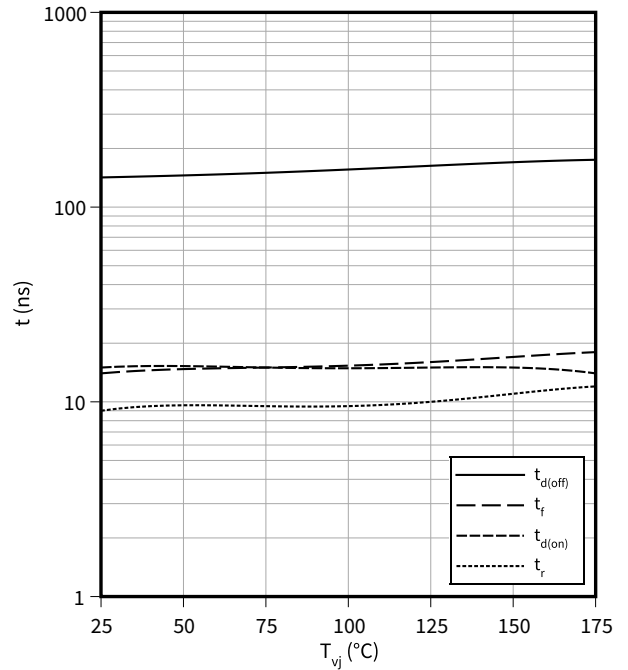
$I_C = 50 \text{ A}, V_{CC} = 400 \text{ V}, T_{vj} = 175 \text{ }^\circ\text{C}, V_{GE} = 0/15 \text{ V}$



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

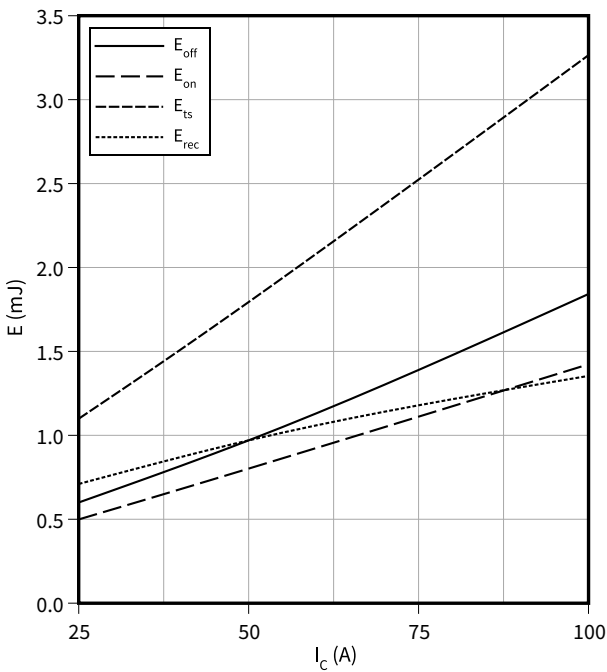
$I_C = 50 \text{ A}, V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V}, R_G = 10 \text{ } \Omega$



Typical switching energy losses as a function of collector current

$E = f(I_C)$

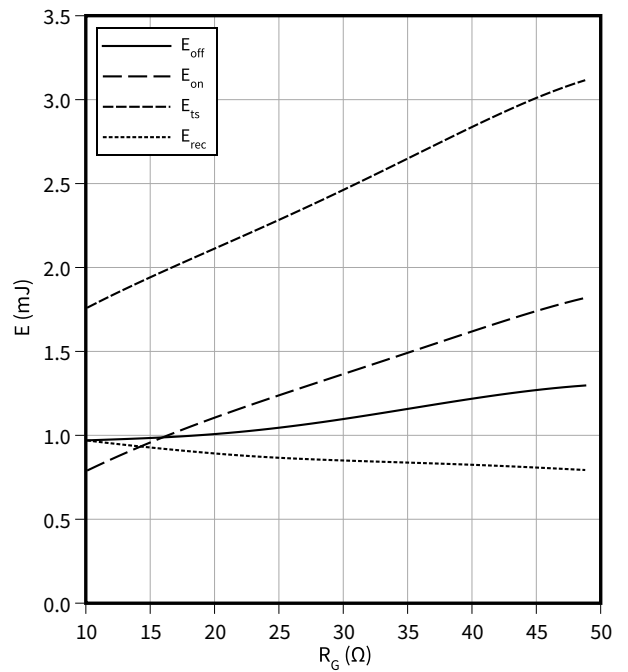
$V_{CC} = 400 \text{ V}, T_{vj} = 175 \text{ }^\circ\text{C}, V_{GE} = 0/15 \text{ V}, R_G = 10 \text{ } \Omega$



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

$I_C = 50 \text{ A}, V_{CC} = 400 \text{ V}, T_{vj} = 175 \text{ }^\circ\text{C}, V_{GE} = 0/15 \text{ V}$

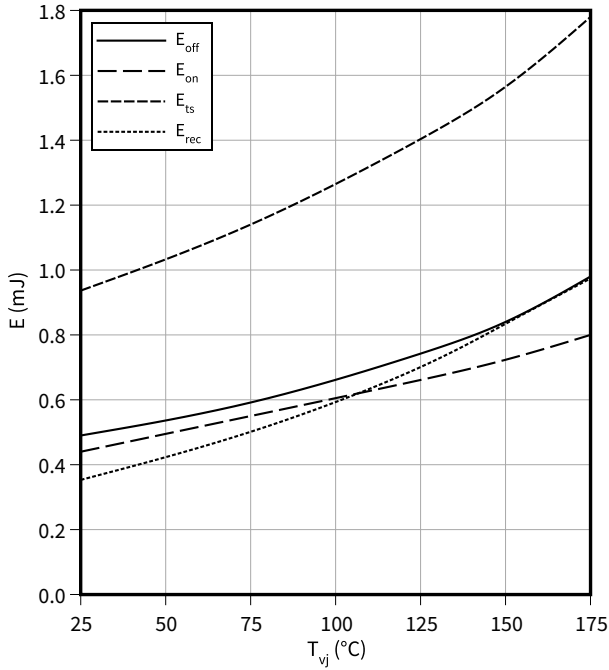


4 Characteristics diagrams

Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

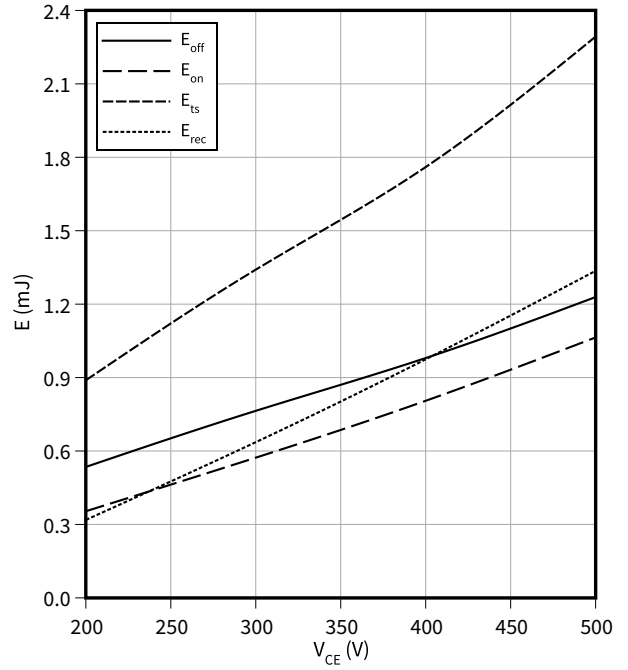
$I_C = 50 \text{ A}, V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V}, R_G = 10 \Omega$



Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$

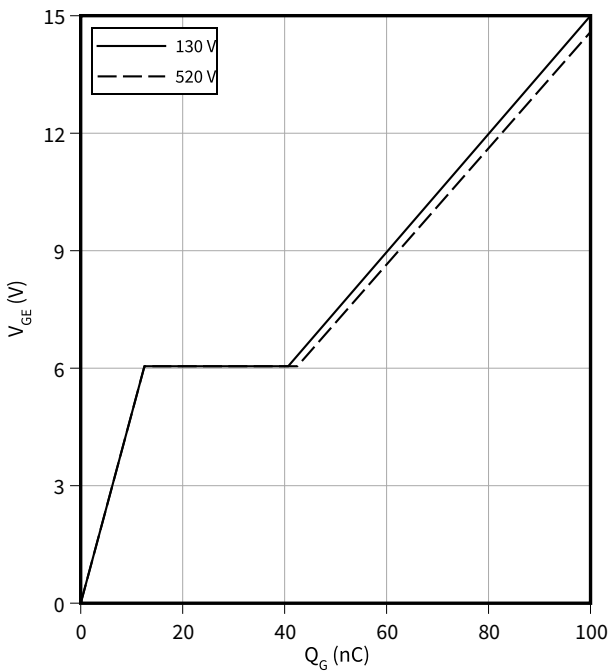
$I_C = 50 \text{ A}, T_{vj} = 175 \text{ °C}, V_{GE} = 0/15 \text{ V}, R_G = 10 \Omega$



Typical gate charge

$V_{GE} = f(Q_G)$

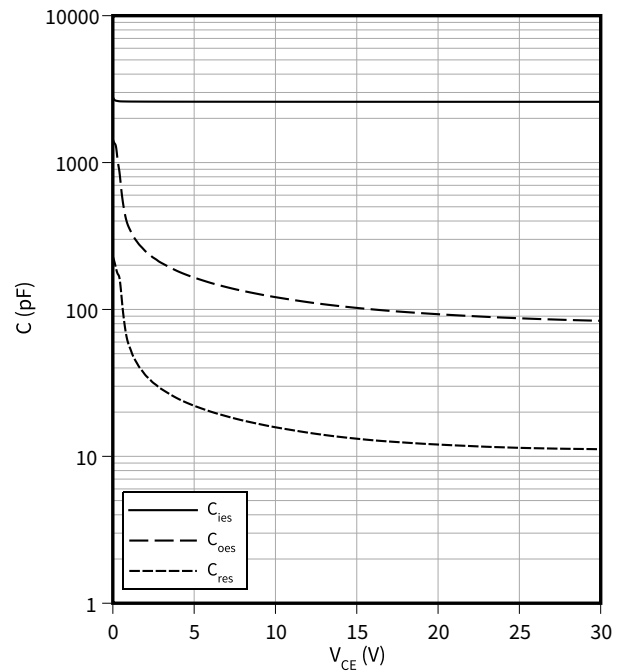
$I_C = 50 \text{ A}$



Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE})$

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

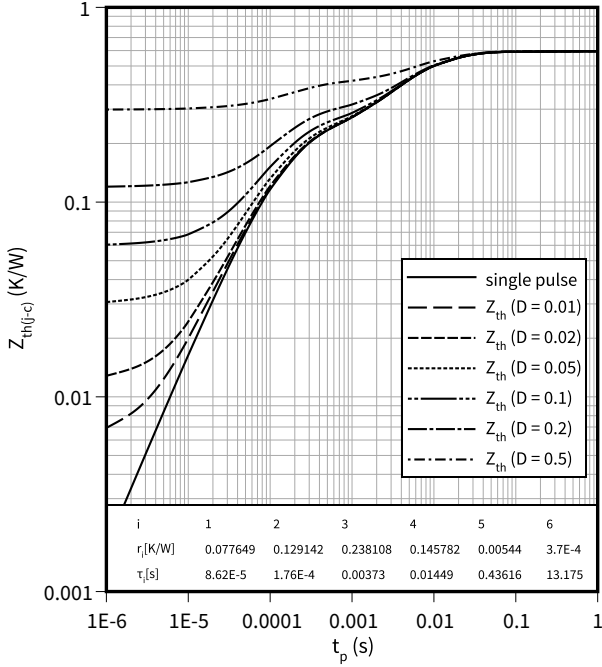


4 Characteristics diagrams

IGBT transient thermal impedance as a function of pulse width

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

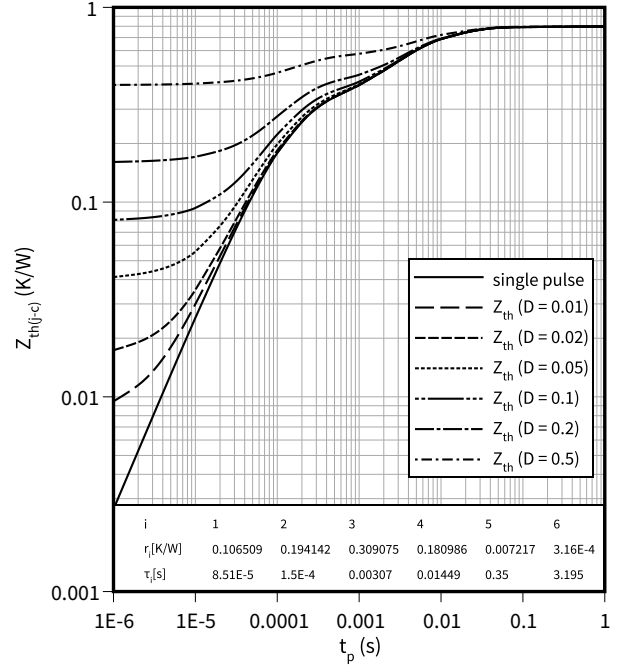
$D = t_p/T$



Diode transient thermal impedance as a function of pulse width

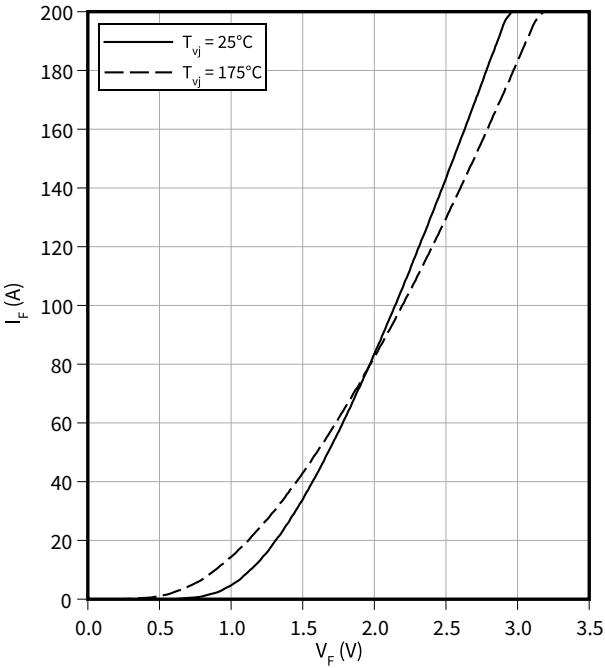
$Z_{th(j-c)} = f(t_p)$

$D = t_p/T$



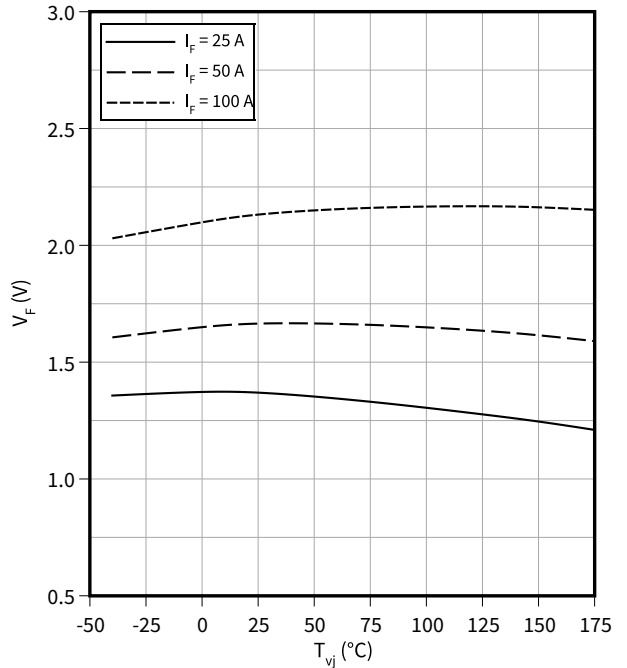
Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



Typical diode forward voltage as a function of junction temperature

$V_F = f(T_{vj})$

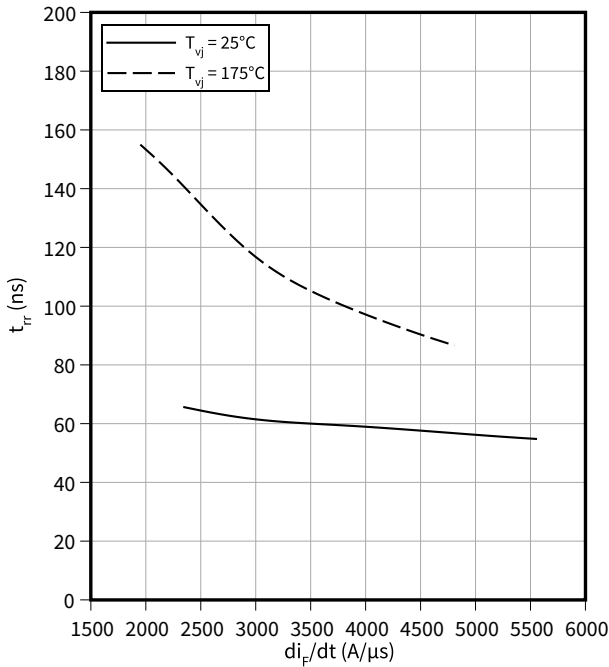


4 Characteristics diagrams

Typical reverse recovery time as a function of diode current slope

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

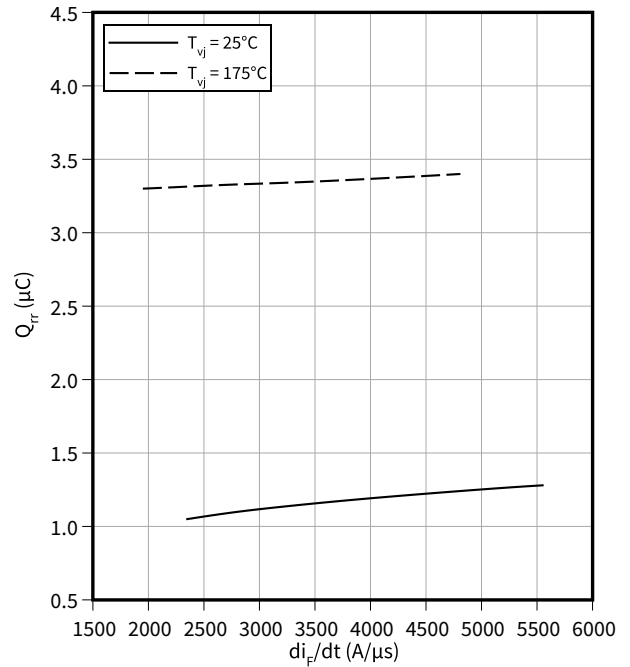
$V_R = 400\text{ V}, I_F = 50\text{ A}$



Typical reverse recovery charge as a function of diode current slope

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

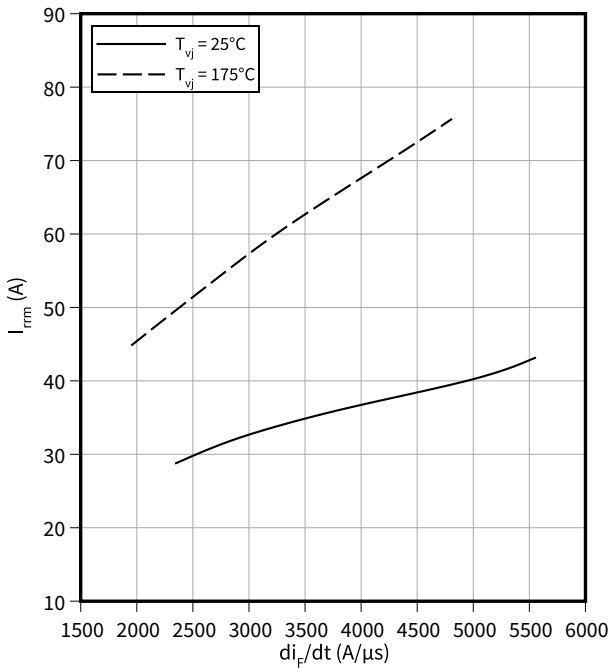
$V_R = 400\text{ V}, I_F = 50\text{ A}$



Typical reverse recovery current as a function of diode current slope

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

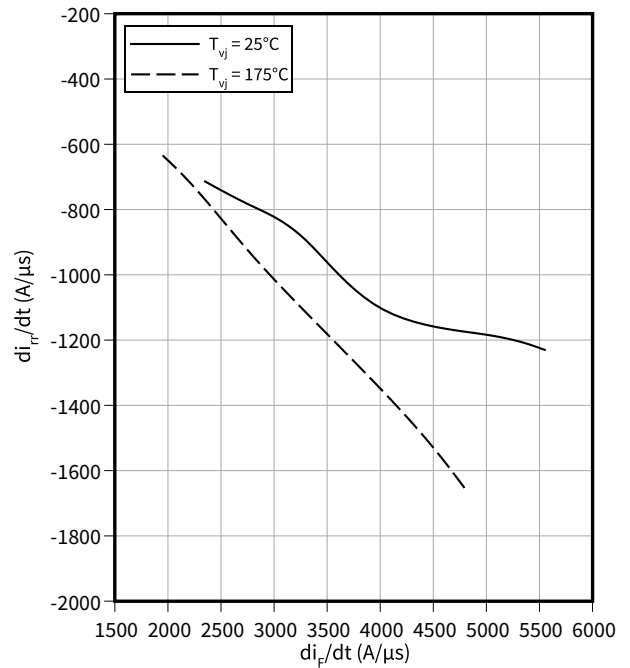
$V_R = 400\text{ V}, I_F = 50\text{ A}$



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

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

$V_R = 400\text{ V}, I_F = 50\text{ A}$

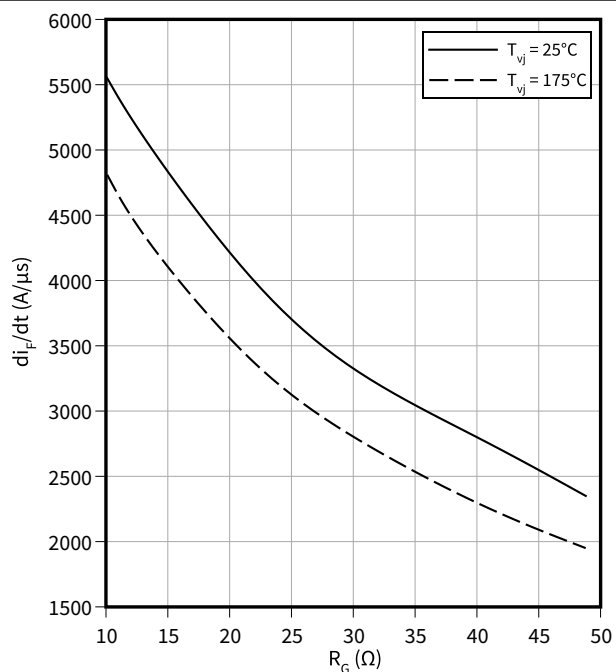


4 Characteristics diagrams

Typical diode current slope as a function of gate resistor

$di_F/dt = f(R_G)$

$V_R = 400\text{ V}, I_F = 50\text{ A}$



5 Package outlines

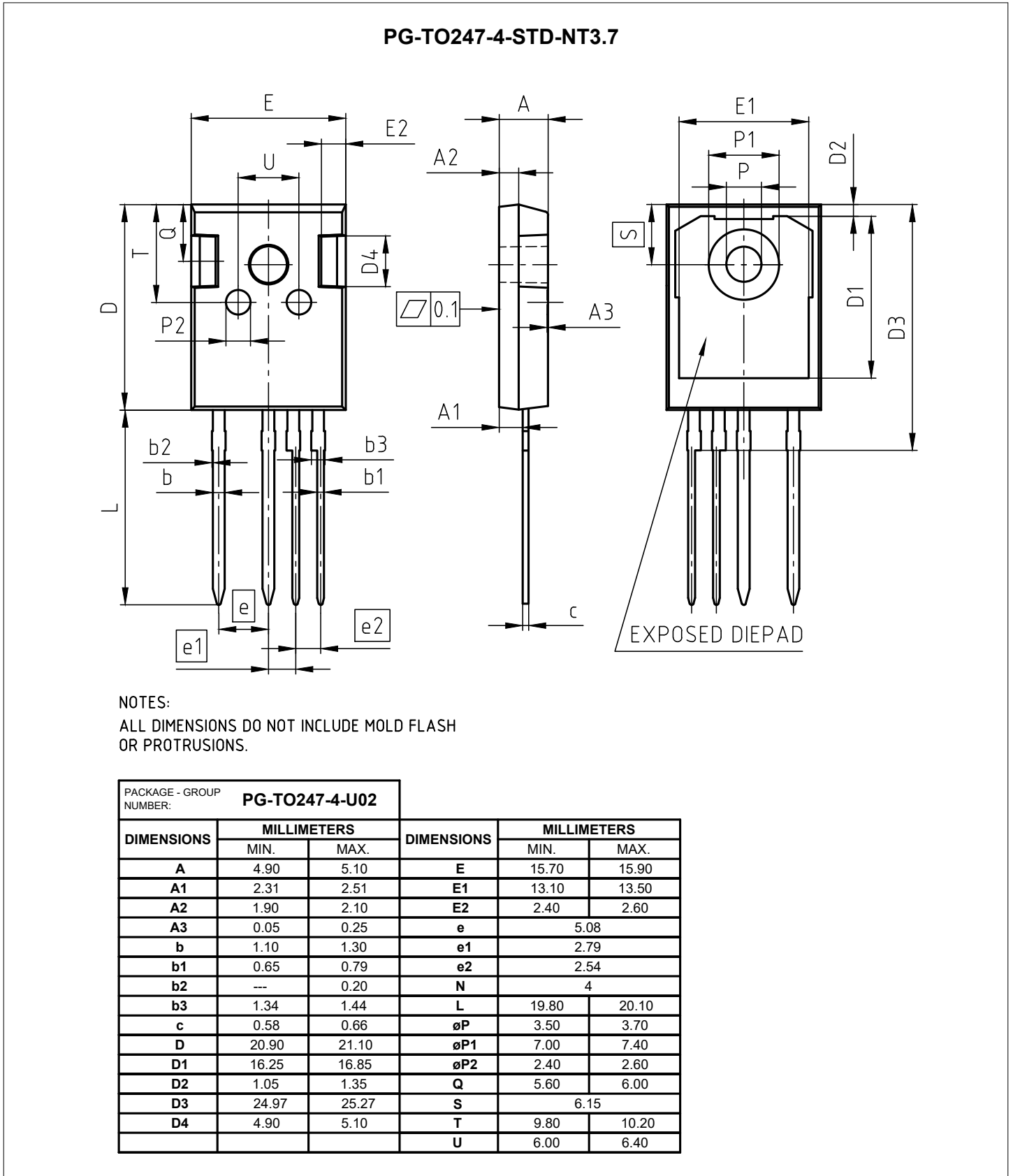


Figure 1

6 Testing conditions

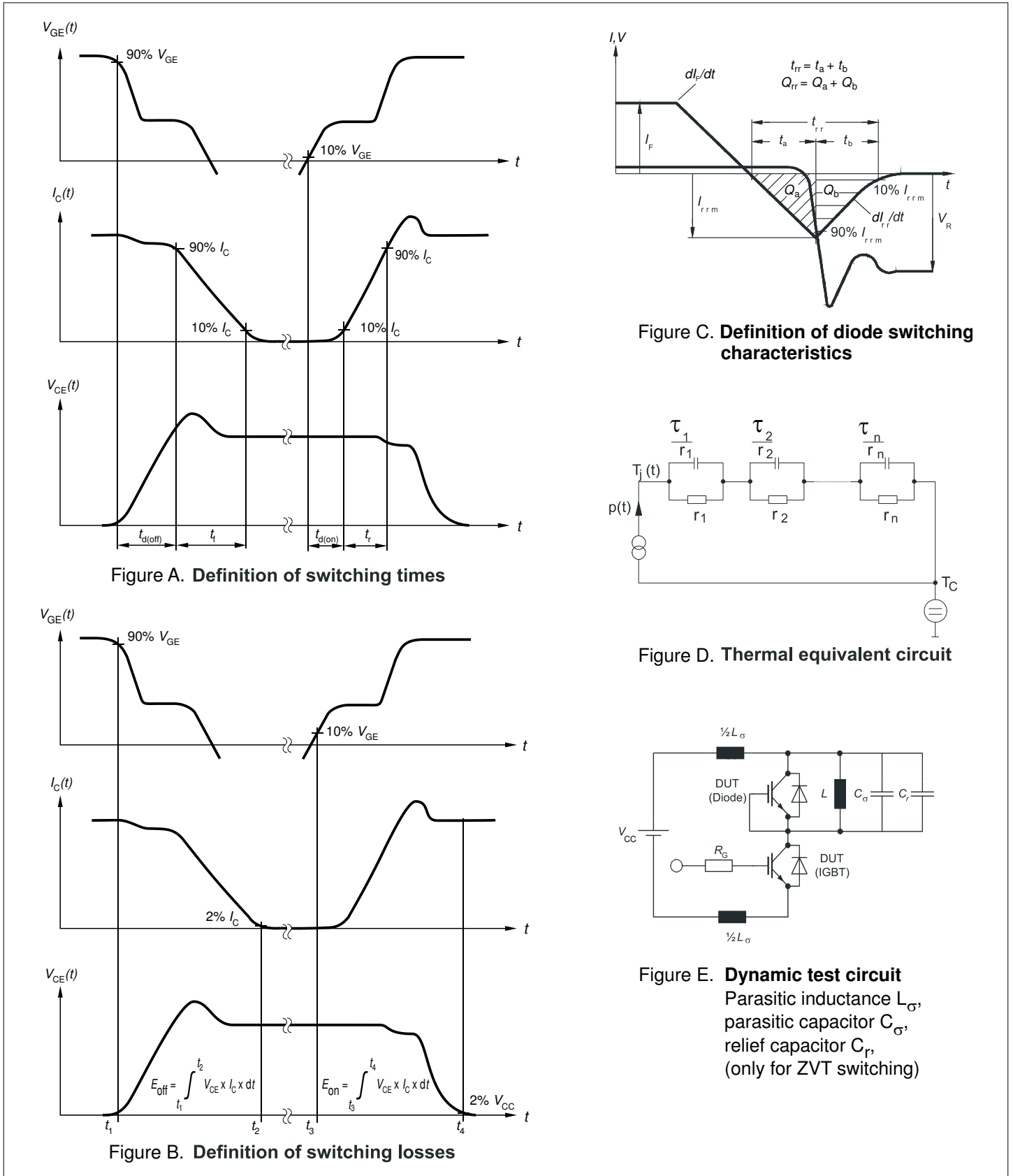


Figure 2

Revision history

Document revision	Date of release	Description of changes
1.00	2023-04-27	Final datasheet
1.10	2023-11-15	Update of energy diagrams

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