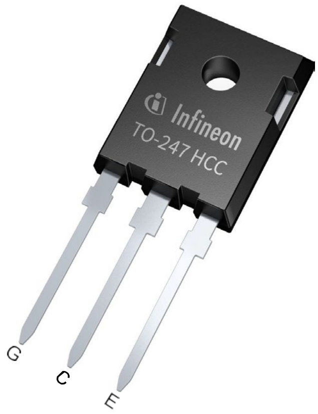
英飞凌 TRENCHSTOP™ 5 WR6 技术采用增强型爬电距离和电气间隙封装，提高了抗封装污染的可靠性

特性



- V_{CE} = 650 V
- I_C = 70 A
- 引脚间爬电距离 > 4.8 毫米
- 引脚间电气间隙 > 3.4 毫米
- 针对 PFC 和焊接应用进行优化的集成二极管
- 稳定的温度特性
- 极低的 V_{CEsat}和低的 E_{off}
- 基于 V_{CEsat}正温度系提升易于并联的能力
- V_{CEsat} 和 E_{sw}的低温度依赖性
- 完整的产品范围和 PSpice 模型： http://www.infineon.com/igbt/

Lead-free

Green

Halogen-free

RoHS

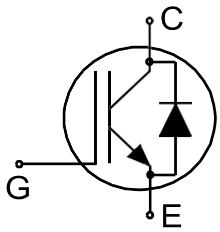
潜在应用

- 功率因数校正
- 焊接
- ZCS应用

产品验证

- 符合JEDEC47/20/22相关测试的工业应用要求

描述



Type	Package	Marking
IKWH70N65WR6	PG-TO247-3-STD-NN4.8	H70EWR6

本数据手册的原文使用英文撰写。为方便起见，英飞凌提供了译文；由于翻译过程中可能使用了自动化工具，英飞凌不保证译文的准确性。为确认准确性，请务必访问 infineon.com 参考最新的英文版本（控制文档）。

目录

1 封装

表 1 特征值

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 process: 3			0.6	Nm
Thermal resistance, junction-ambient	$R_{th(j-a)}$				40	K/W
IGBT thermal resistance, junction-case	$R_{th(j-c)}$				0.5	K/W
Diode thermal resistance, junction-case	$R_{th(j-c)}$				1.9	K/W

2 IGBT

表2 最大额定值

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CE}	$T_{vj} \geq 25$ °C		650	V
DC collector current, limited by T_{vjmax}	I_C		$T_c = 25$ °C	122	A
			$T_c = 100$ °C	77	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}			210	A
Turn-off safe operating area		$V_{CE} \leq 650$ V, $T_{vj} \leq 175$ °C		210	A
Gate-emitter voltage	V_{GE}			±20	V
Transient gate-emitter voltage	V_{GE}	$t_p \leq 10$ µs, $D < 0.01$		±30	V
Power dissipation	P_{tot}		$T_c = 25$ °C	290	W
			$T_c = 100$ °C	145	

表3 特征值

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter breakdown voltage	V_{BRCES}	$I_C = 0.2$ mA, V_{GE}=0 V	650			V

（表格续下页……）

表 3 （续） 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	V_{CEsat}	I_C = 70 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.55	1.85	V
			T_{vj} = 175 °C		1.8		
Gate-emitter threshold voltage	V_{GEth}	I_C = 0.7 mA, V_{CE} = V_{GE}		3.2	4	4.8	V
Zero gate-voltage collector current	I_{CES}	V_{CE} = 650 V, V_{GE}=0 V	T_{vj} = 25 °C			40	µA
			T_{vj} = 175 °C		0.5		mA
Gate-emitter leakage current	I_{GES}	V_{CE}=0 V, V_{GE} = 20 V				100	nA
Transconductance	g_{fs}	I_C = 70 A, V_{CE} = 20 V			155		S
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE}=0 V, f = 100 kHz			5320		pF
Output capacitance	C_{oes}	V_{CE} = 25 V, V_{GE}=0 V, f = 100 kHz			52		pF
Reverse transfer capacitance	C_{res}	V_{CE} = 25 V, V_{GE}=0 V, f = 100 kHz			22		pF
Gate charge	Q_G	I_C = 70 A, V_{GE} = 15 V, V_{CC} = 520 V			218		nC
Turn-on delay time	$t_{d(on)}$	V_{CC} = 400 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 15 Ω, $R_{G(off)}$ = 15 Ω, L_σ = 30 nH, C_σ = 20 pF	T_{vj} = 25 °C, I_C = 70 A		42		ns
			T_{vj} = 175 °C, I_C = 70 A		39		
Rise time (inductive load)	t_r	V_{CC} = 400 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 15 Ω, $R_{G(off)}$ = 15 Ω, L_σ = 30 nH, C_σ = 20 pF	T_{vj} = 25 °C, I_C = 70 A		31		ns
			T_{vj} = 175 °C, I_C = 70 A		33		
Turn-off delay time	$t_{d(off)}$	V_{CC} = 400 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 15 Ω, $R_{G(off)}$ = 15 Ω, L_σ = 30 nH, C_σ = 20 pF	T_{vj} = 25 °C, I_C = 70 A		378		ns
			T_{vj} = 175 °C, I_C = 70 A		423		
Fall time (inductive load)	t_f	V_{CC} = 400 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 15 Ω, $R_{G(off)}$ = 15 Ω, L_σ = 30 nH, C_σ = 20 pF	T_{vj} = 25 °C, I_C = 70 A		26		ns
			T_{vj} = 175 °C, I_C = 70 A		20		
Turn-on energy	E_{on}	V_{CC} = 400 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 15 Ω, $R_{G(off)}$ = 15 Ω, L_σ = 30 nH, C_σ = 20 pF	T_{vj} = 25 °C, I_C = 70 A		2.2		mJ
			T_{vj} = 175 °C, I_C = 70 A		2.35		

（表格续下页......）

表 3 （续） 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Turn-off energy	E_{off}	V_{CC} = 400 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 15 Ω, $R_{G(off)}$ = 15 Ω, $L_σ$ = 30 nH, $C_σ$ = 20 pF	T_{vj} = 25 °C, I_C = 70 A		1.07		mJ
			T_{vj} = 175 °C, I_C = 70 A		1.48		
Total switching energy	E_{ts}	V_{CC} = 400 V, V_{GE} = 0/15 V, $R_{G(on)}$ = 15 Ω, $R_{G(off)}$ = 15 Ω, $L_σ$ = 30 nH, $C_σ$ = 20 pF	T_{vj} = 25 °C, I_C = 70 A		3.26		mJ
			T_{vj} = 175 °C, I_C = 70 A		3.83		
Operating junction temperature	T_{vj}			-40		175	°C

注： 电气特性，在 T_{vj} = 25°C 条件下测得，除非另有规定。

3 二极管

表4 最大额定值

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}	T_{vj} ≥ 25 °C		650	V
Diode forward current, limited by T_{vjmax}	I_F		T_c = 25 °C	37	A
			T_c = 100 °C	22	
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpulse}			70	A

表5 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode forward voltage	V_F	I_F = 21.5 A	T_{vj} = 25 °C		1.3	1.6	V
			T_{vj} = 175 °C		1.35		
Diode reverse recovery time	t_{rr}	V_R = 400 V	T_{vj} = 25 °C, I_F = 35 A, $-di_F/dt$ = 1870 A/µs		98		ns
			T_{vj} = 175 °C, I_F = 35 A, $-di_F/dt$ = 1800 A/µs		120		

（表格续下页……）

表 5　　（续） 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode reverse recovery charge	Q_{rr}	V_R = 400 V	T_{vj} = 25 °C, I_F = 35 A, $-di_F/dt$ = 1870 A/µs		2.8		µC
			T_{vj} = 175 °C, I_F = 35 A, $-di_F/dt$ = 1800 A/µs		4.5		
Diode peak reverse recovery current	I_{rrm}	V_R = 400 V	T_{vj} = 25 °C, I_F = 35 A, $-di_F/dt$ = 1870 A/µs		40.3		A
			T_{vj} = 175 °C, I_F = 35 A, $-di_F/dt$ = 1800 A/µs		59		
Diode peak rate of fall of reverse recovery current	di_{rr}/dt	V_R = 400 V	T_{vj} = 25 °C, I_F = 35 A, $-di_F/dt$ = 1870 A/µs		700		A/µs
			T_{vj} = 175 °C, I_F = 35 A, $-di_F/dt$ = 1800 A/µs		866		
Operating junction temperature	T_{vj}			-40		175	°C

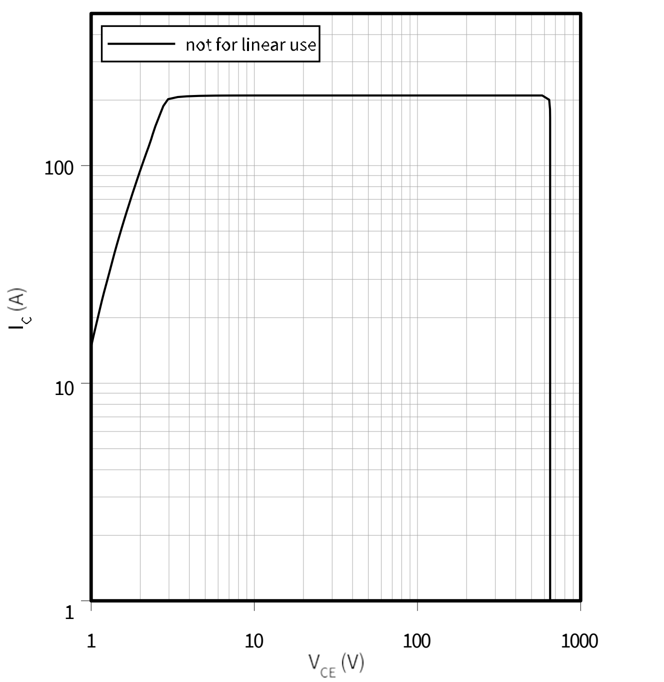
注意：为了获得最佳的使用寿命和可靠性，英飞凌建议运行条件不超过本数据手册中所述最大额定值的80%。

4 特性图

Reverse bias safe operating area

$I_C = f(V_{CE})$

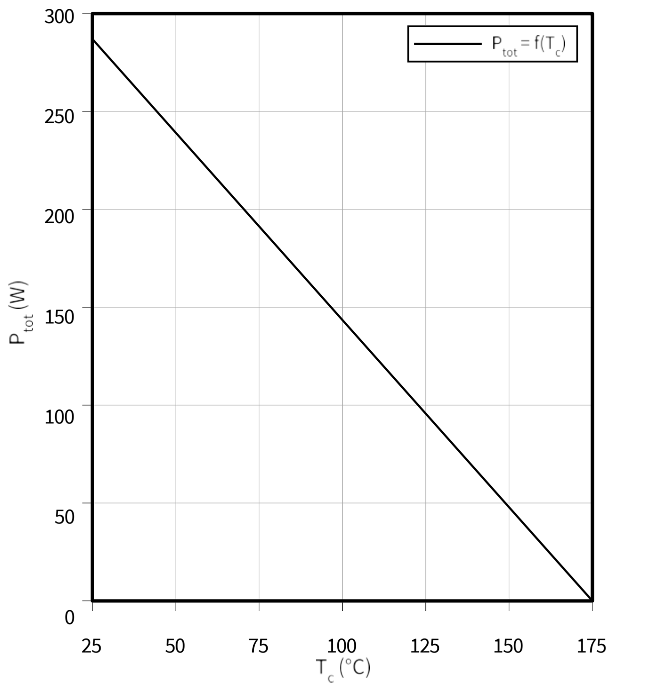
$T_{vj} \leq 175$ °C, $T_c = 25$ °C, $V_{GE} = 15$ V



Power dissipation as a function of case temperature

$P_{tot} = f(T_c)$

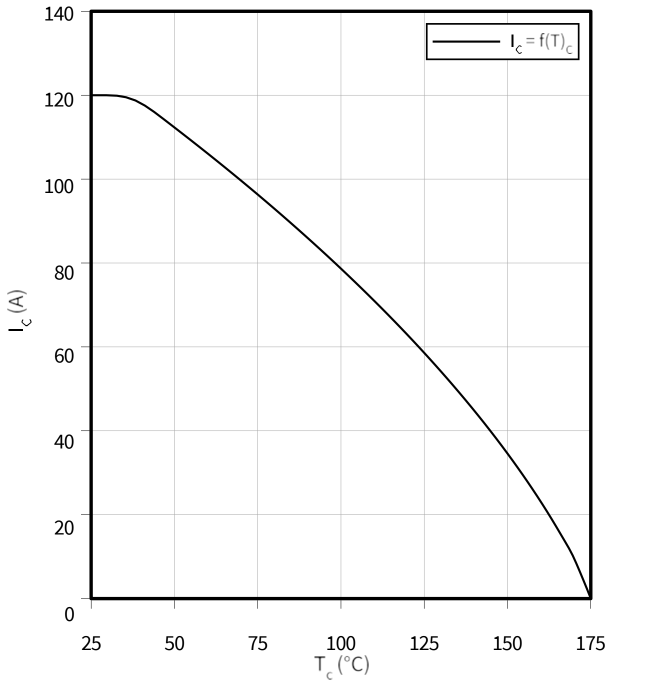
$T_{vj} \leq 175$ °C



Collector current as a function of case temperature

$I_C = f(T_c)$

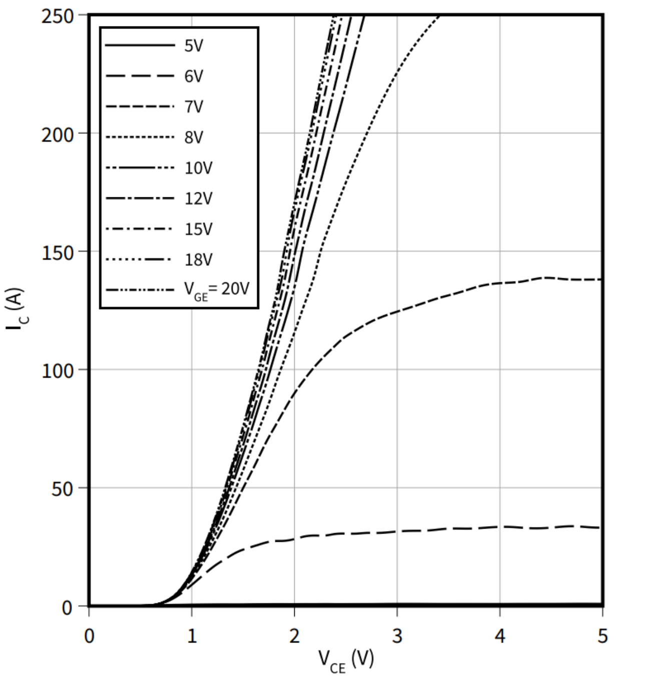
$V_{GE} \geq 15$ V, $T_{vj} \leq 175$ °C



Typical output characteristic

$I_C = f(V_{CE})$

$T_{vj} = 25$ °C

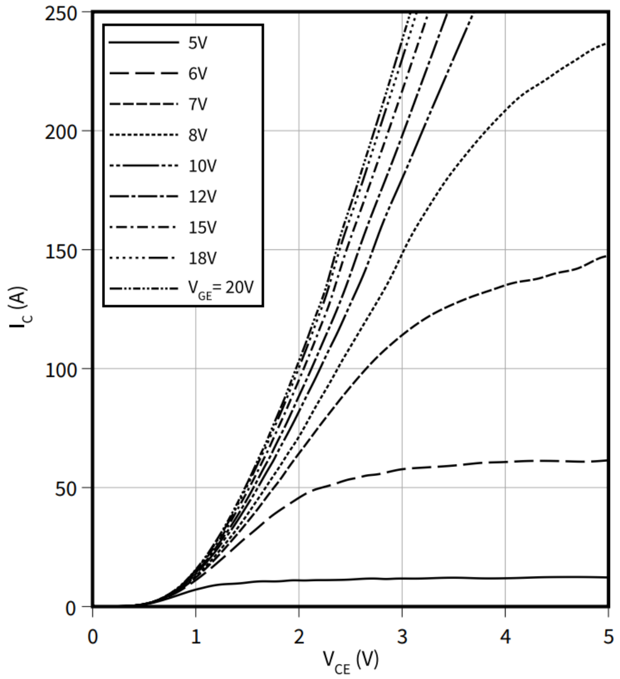


4 特性图

Typical output characteristic

$I_C = f(V_{CE})$

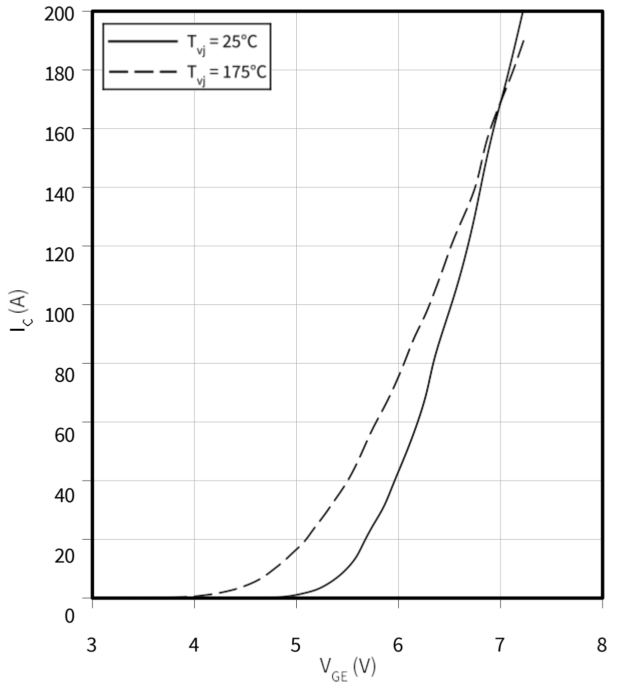
$T_{vj} = 175\ °C$



Typical transfer characteristic

$I_C = f(V_{GE})$

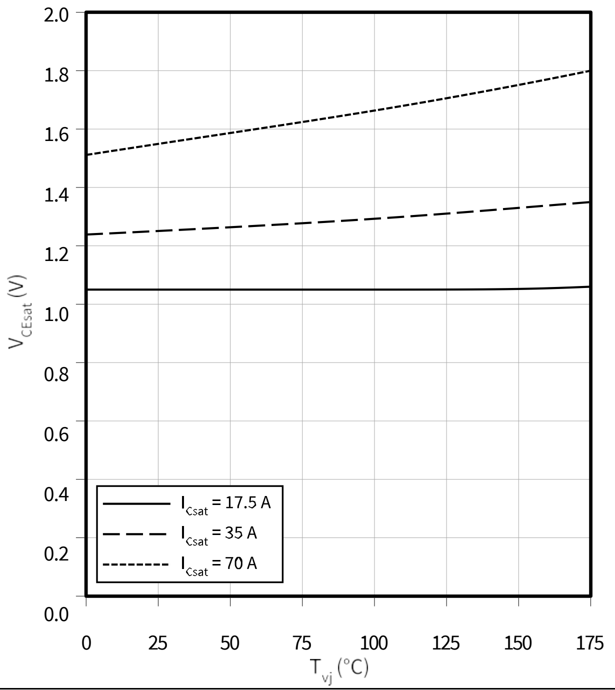
$V_{CE} = 20\ V$



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

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

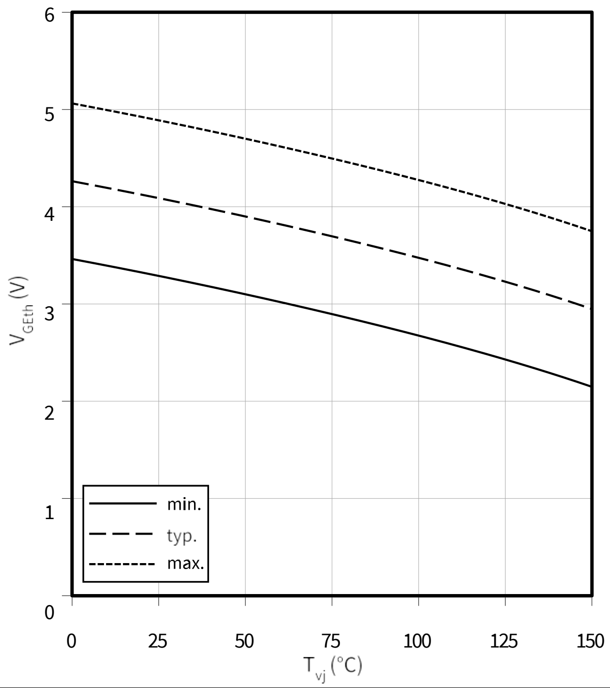
$V_{GE} = 15\ V$



Gate-emitter threshold voltage as a function of junction temperature

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

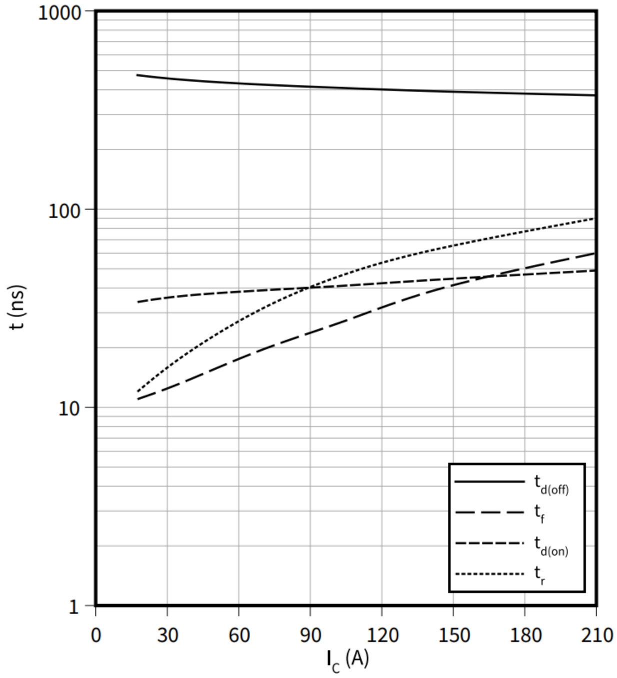
$I_C = 0.7\ mA$



Typical switching times as a function of collector current

$t = f(I_C)$

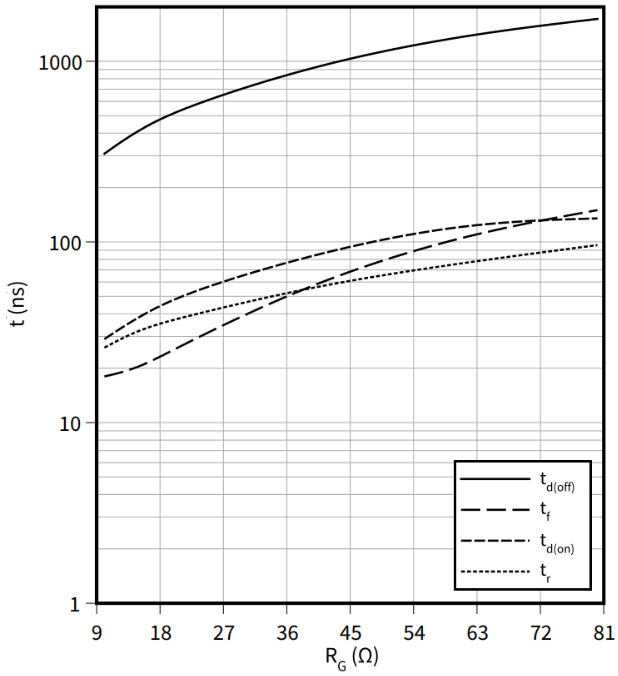
$V_{CC} = 400$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 15$ Ω



Typical switching times as a function of gate resistor

$t = f(R_G)$

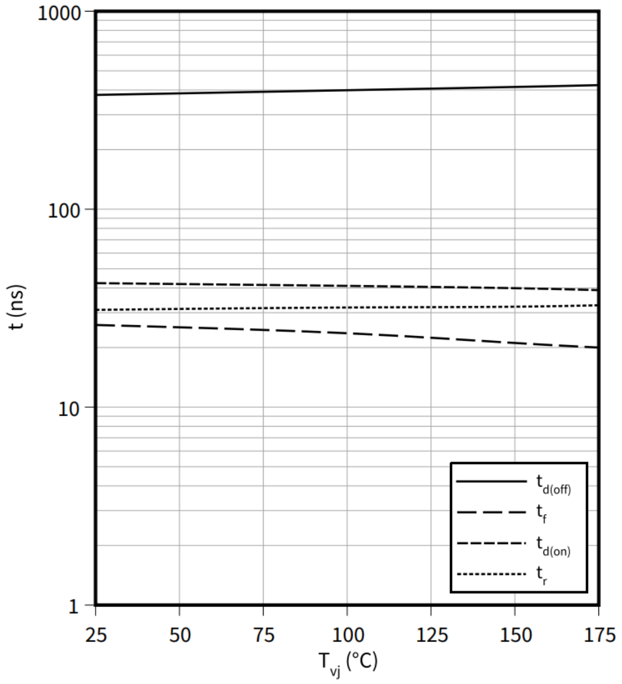
$I_C = 70$ A, $V_{CC} = 400$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

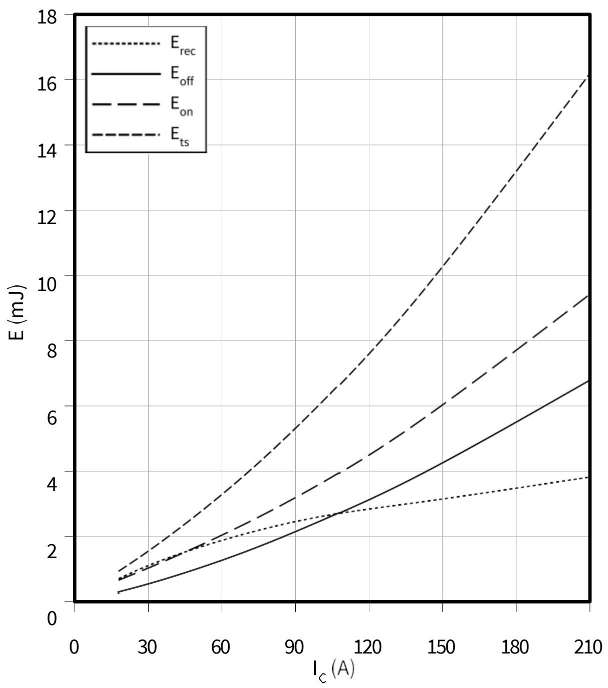
$I_C = 70$ A, $V_{CC} = 400$ V, $V_{GE} = 0/15$ V, $R_G = 15$ Ω



Typical switching energy losses as a function of collector current

$E = f(I_C)$

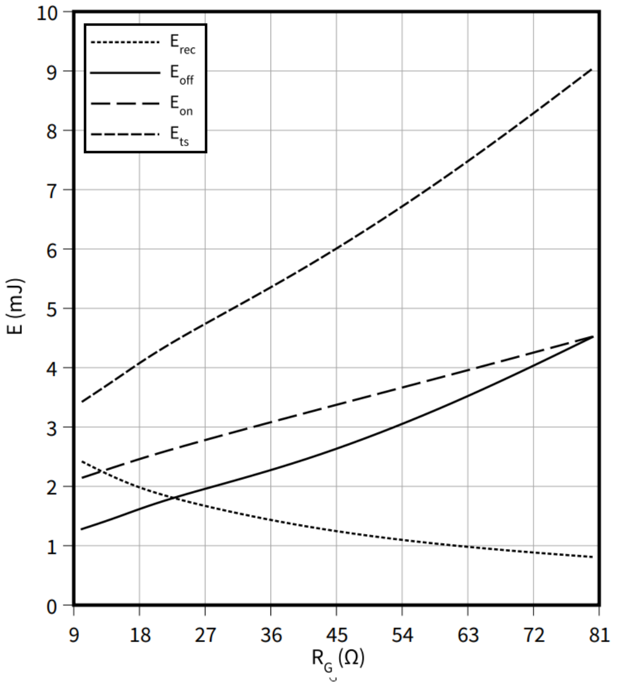
$V_{CC} = 400$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 15$ Ω



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

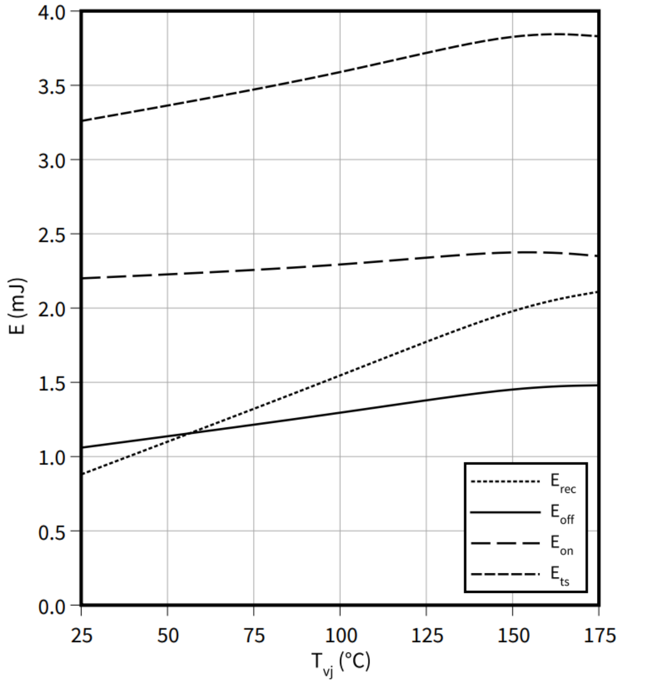
$I_C = 70$ A, $V_{CC} = 400$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V



Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

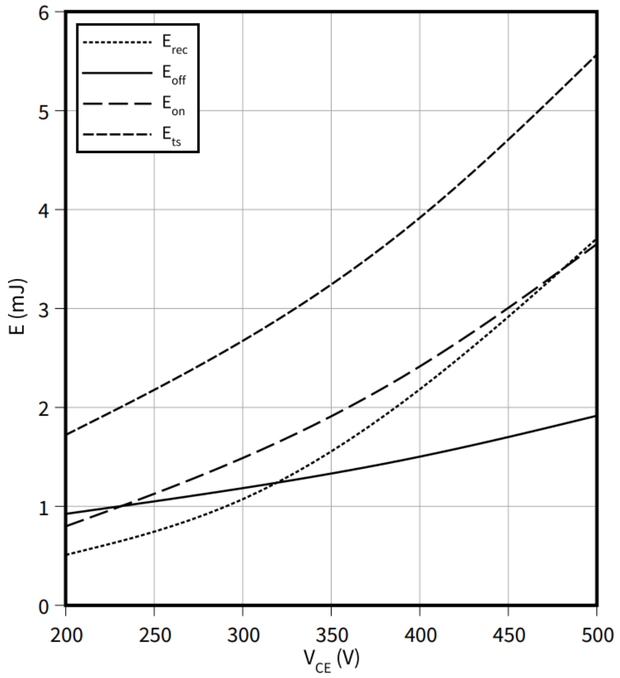
$I_C = 70$ A, $V_{CC} = 400$ V, $V_{GE} = 0/15$ V, $R_G = 15$ Ω



Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$

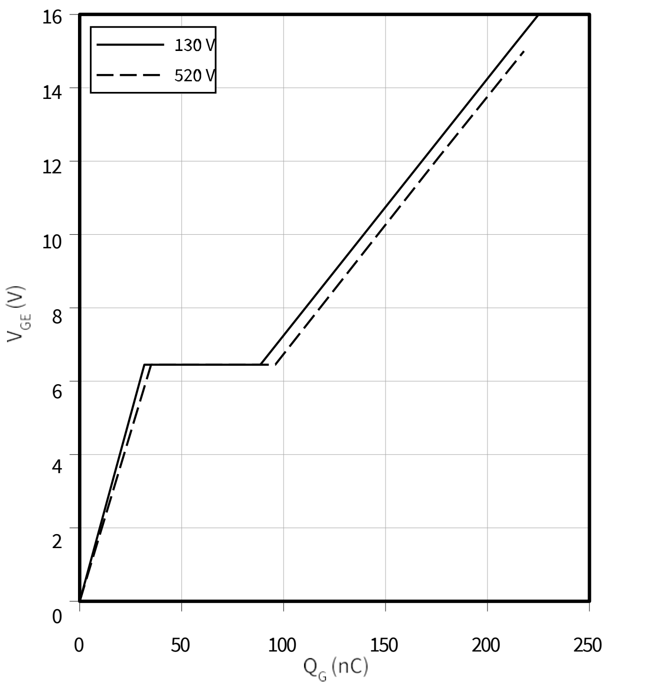
$I_C = 70$ A, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 15$ Ω



Typical gate charge

$V_{GE} = f(Q_G)$

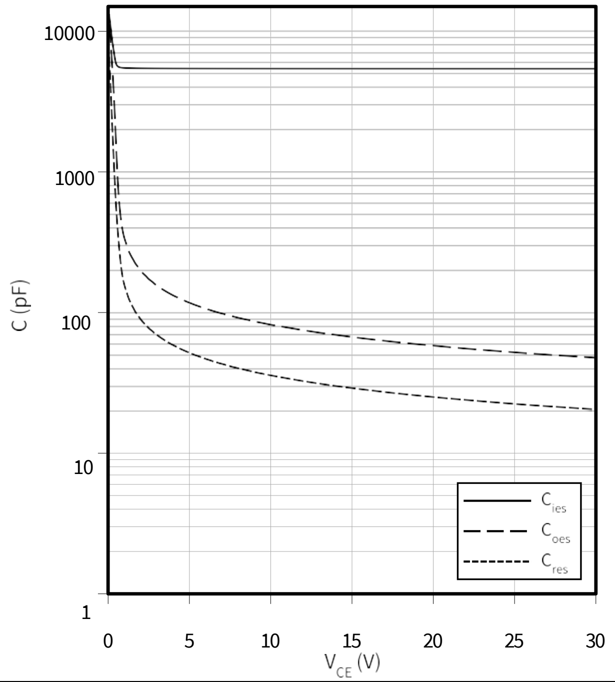
$I_C = 70$ A



Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE})$

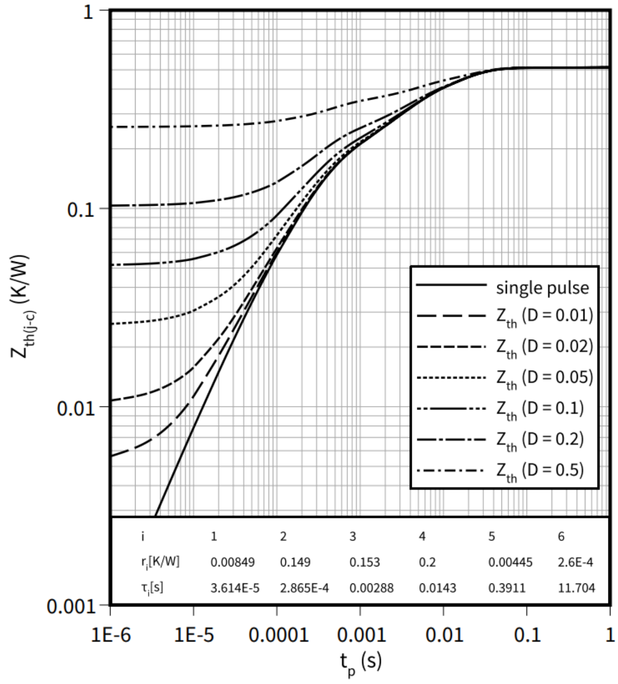
$f = 100$ kHz, $V_{GE} = 0$ V



IGBT transient thermal impedance as a function of pulse width

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

$D = t_p/T$

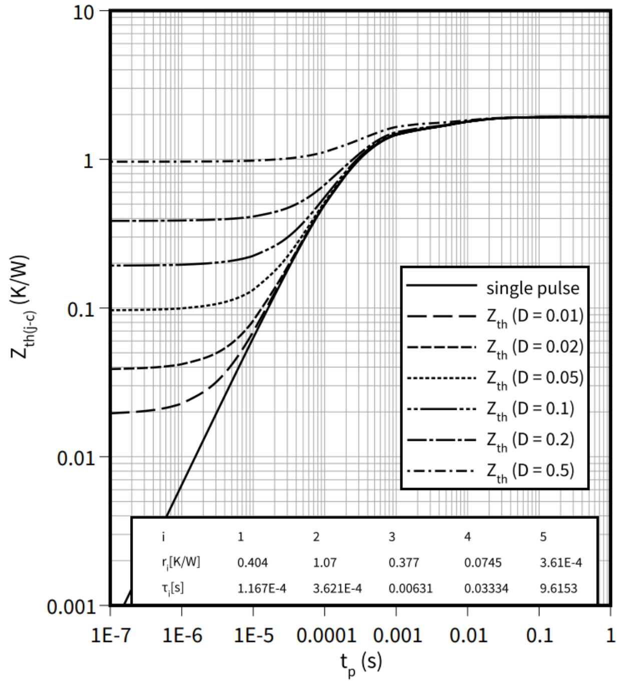


i	1	2	3	4	5	6
r_i[K/W]	0.00849	0.149	0.153	0.2	0.00445	2.6E-4
τ_i[s]	3.614E-5	2.865E-4	0.00288	0.0143	0.3911	11.704

Diode transient thermal impedance as a function of pulse width

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

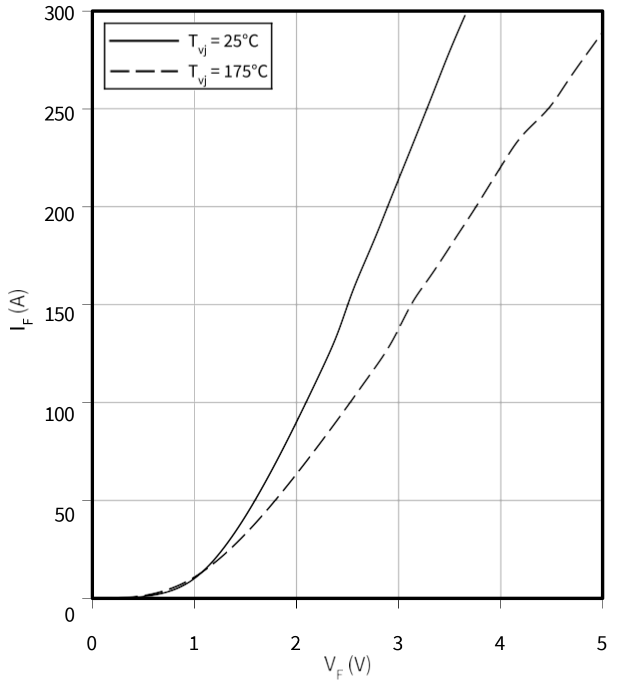
$D = t_p/T$

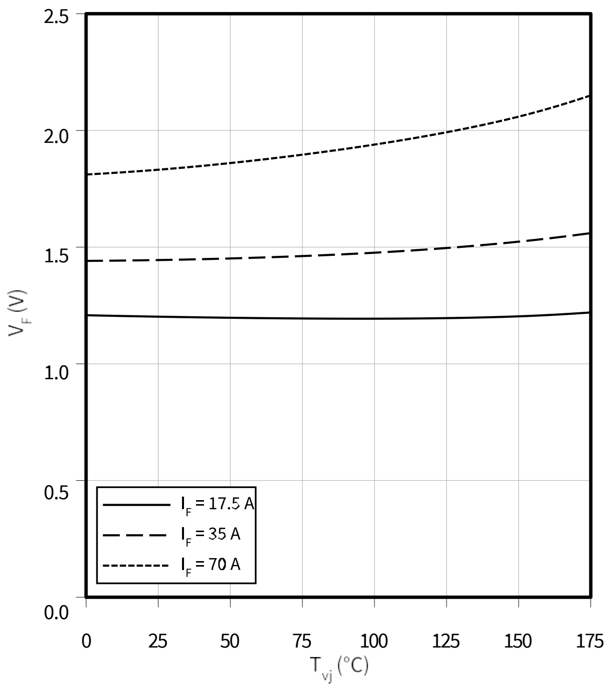
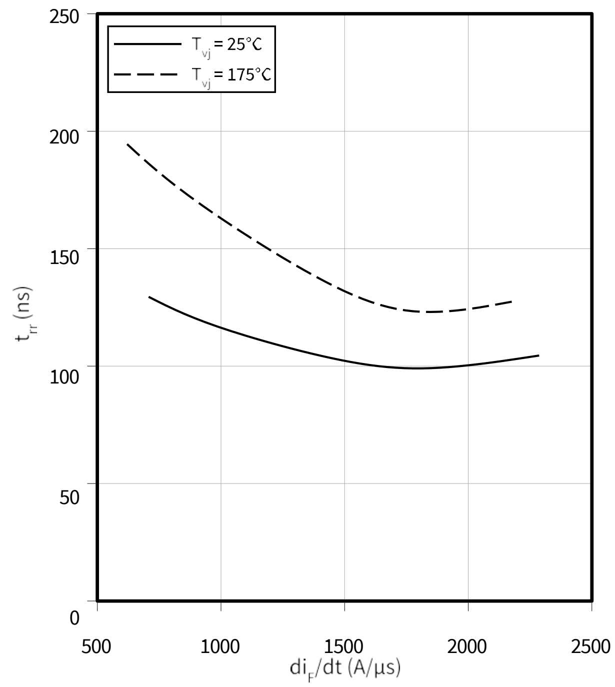
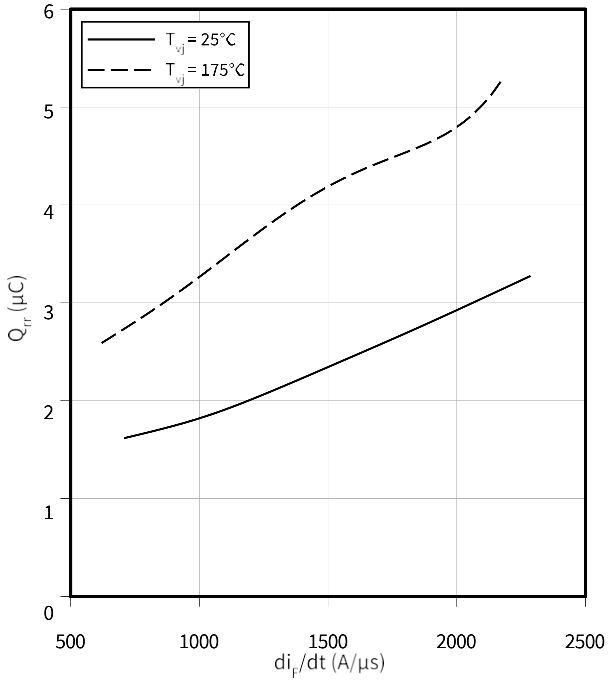
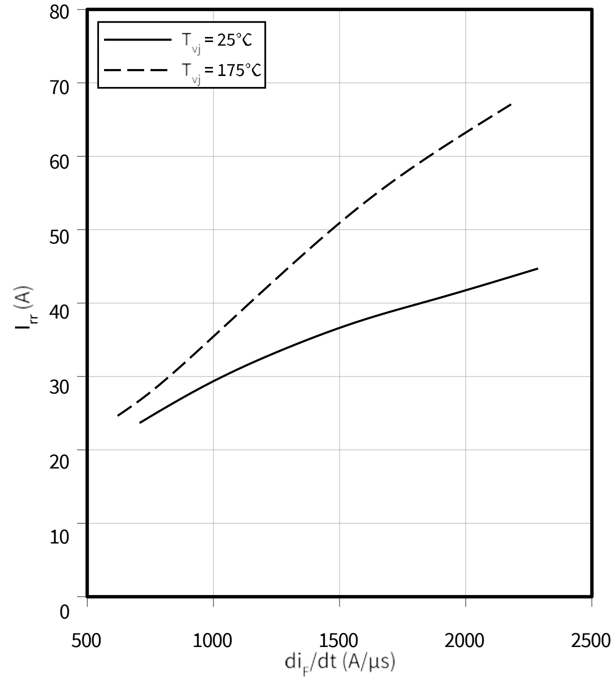


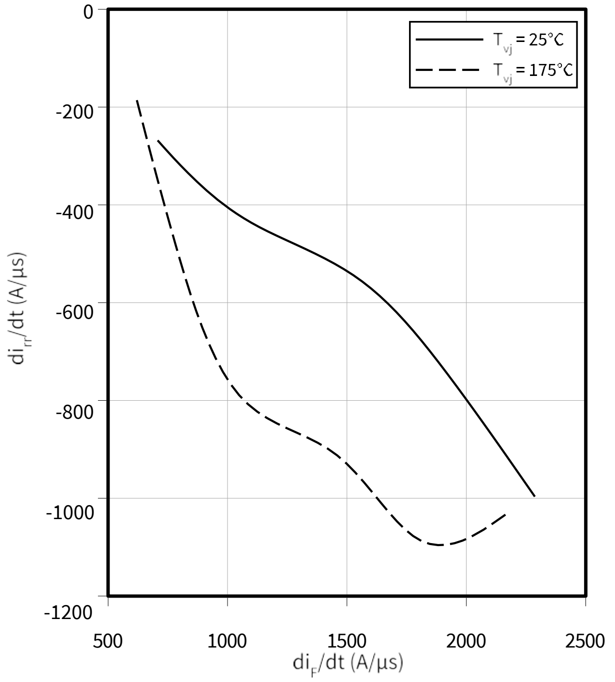
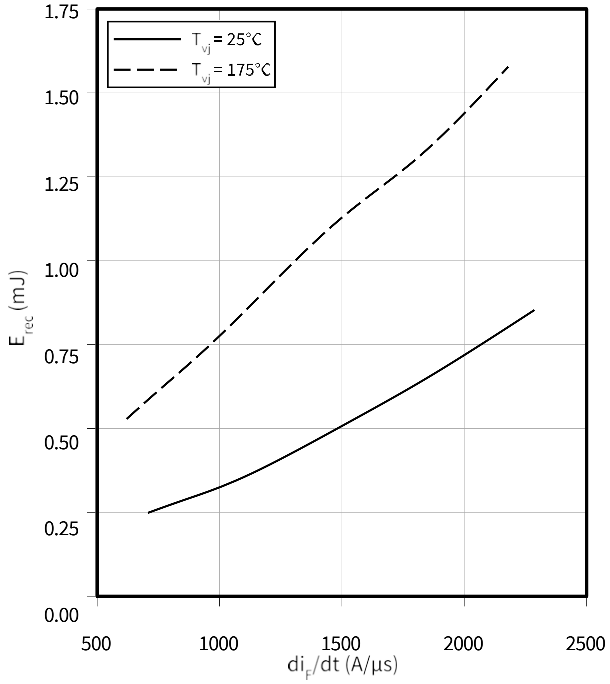
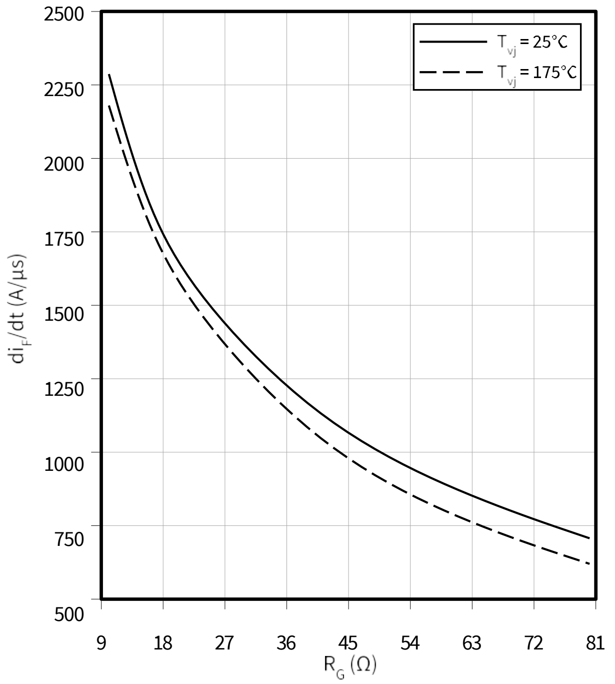
i	1	2	3	4	5
r_i[K/W]	0.404	1.07	0.377	0.0745	3.61E-4
τ_i[s]	1.167E-4	3.621E-4	0.00631	0.03334	9.6153

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$

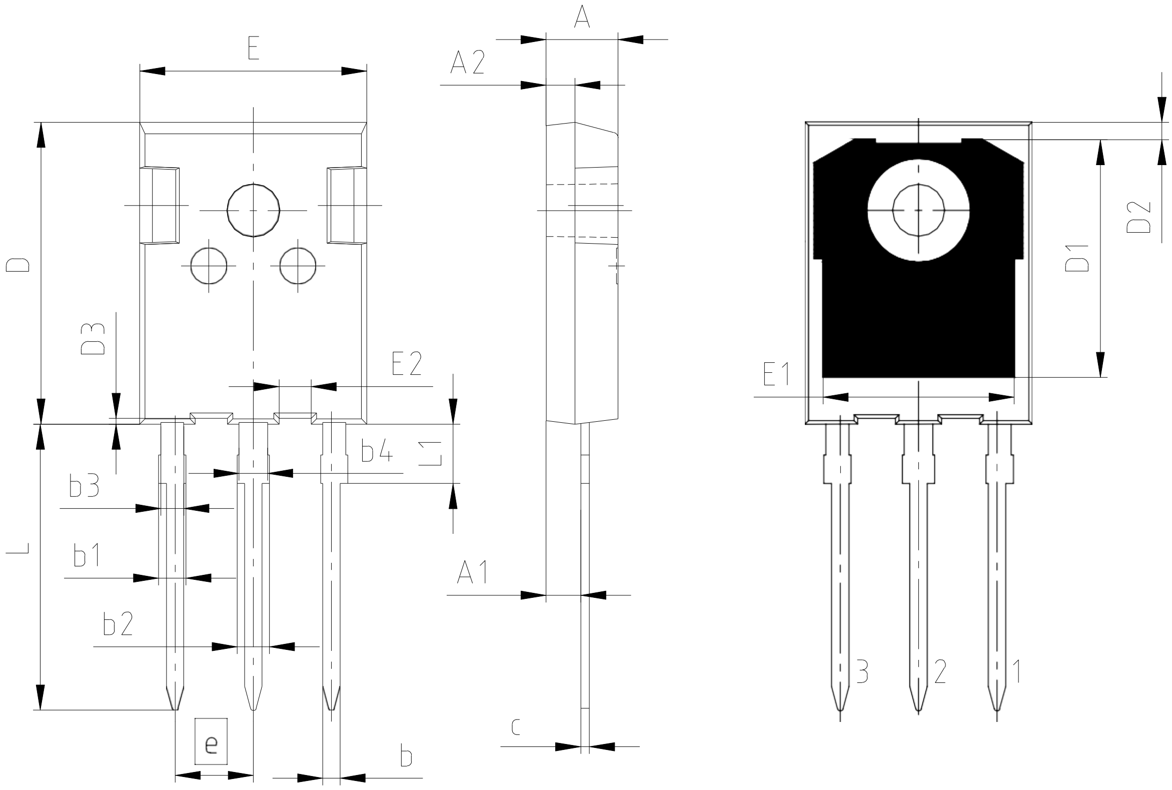


Typical diode forward voltage as a function of junction temperature $V_F = f(T_{vj})$	**Typical reverse recovery time as a function of diode current slope** $t_{rr} = f(di_F/dt)$ $V_R = 400$ V, $I_F = 35$ A
	
Typical reverse recovery charge as a function of diode current slope $Q_{rr} = f(di_F/dt)$ $V_R = 400$ V, $I_F = 35$ A	**Typical reverse recovery current as a function of diode current slope** $I_{rrm} = f(di_F/dt)$ $V_R = 400$ V, $I_F = 35$ A
	

Typical diode peak rate of fall of reverse recovery current as a function of diode current slope $di_{rr}/dt = f(di_F/dt)$ $V_R = 400$ V, $I_F = 35$ A	**Typical reverse energy losses as a function of diode current slope** $E_{rec} = f(di_F/dt)$ $V_R = 400$ V, $I_F = 35$ A
	
Typical diode current slope as a function of gate resistor $di_F/dt = f(R_G)$ $V_R = 400$ V, $I_F = 35$ A	
	

5 封装外形

PG-TO247-3-STD-NN4.8



PACKAGE - GROUP NUMBER:	PG-TO247-3-U04	
DIMENSIONS	**MILLIMETERS**	
	MIN.	MAX.
A	4.90	5.10
A1	2.31	2.51
A2	1.90	2.10
b	1.16	1.26
b1		1.90
b2		2.30
b3	1.55	1.65
b4	1.96	2.06
c	0.59	0.66
D	20.90	21.10
D1	16.25	16.85
D2	1.05	1.35
D3	0.55	0.65
E	15.70	15.90
E1	13.10	13.50
E2	2.14	2.34
e	5.44	
N	3	
L	19.80	20.10
L1	3.95	4.30

图 1

6 测试条件

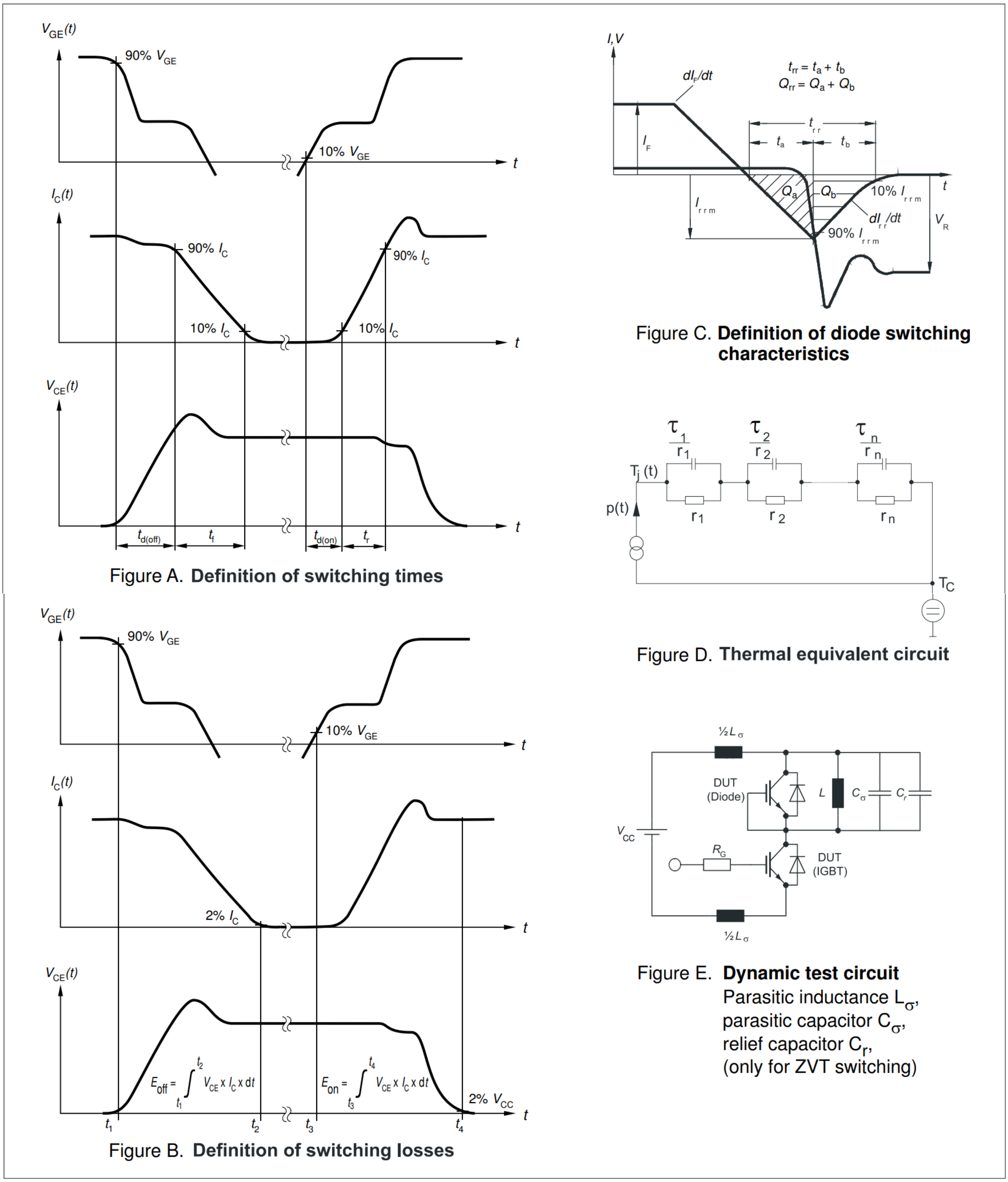


Figure A. Definition of switching times
Figure B. Definition of switching losses
Figure C. Definition of diode switching characteristics
Figure D. Thermal equivalent circuit
Figure E. Dynamic test circuit
Parasitic inductance Lσ,
parasitic capacitor Cσ,
relief capacitor Cr,
(only for ZVT switching)
90% VGE
10% VGE
90% IC
10% IC
2% IC
2% VCC
td(off)
tf
td(on)
tr
trr = ta + tb
Qrr = Qa + Qb
10% Irrm
90% Irrm
Tj (t)
p(t)
TC
DUT
(Diode)
DUT
(IGBT)
VCC

图 2

修订记录

Document revision	Date of release	Description of changes
1.00	2021-05-21	Final datasheet
1.10	2022-12-06	Update of “DC collector current, limited by T_{vjmax}” in table “Maximum rated values”, for 25°C and 100°C Transient gate-emitter voltage V_{GE} in table “Maximum rated values” of IGBT changed to ±30V Update of diagram “Collector current as a function of case temperature”, $I_C = f(T_c)$ Update of diagram "Typical gate charge", $V_{GE} = f(Q_{GE})$ "Forward bias safe operating area” diagram renamed to “Reverse bias safe operating area” Correction of package outline dimensions Change package name to marketing name Editorial changes

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