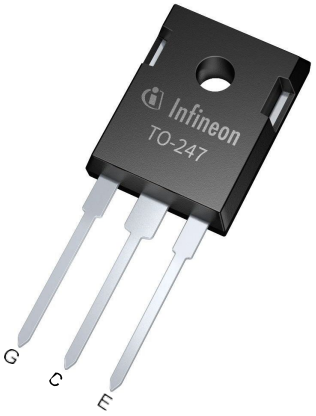
英飞凌 CoolSiC™ 混合单管 - TRENCHSTOP™ 5 S5 IGBT

与全额定值第六代 CoolSiC™ 二极管共同封装



特性

- V_{CE} = 650 V
- I_C = 75 A
- TRENCHSTOP™ 5 与 CoolSiC™ 技术相结合，实现超低开关损耗
- 导通损耗非常低
- 硬开关拓扑中的基准效率
- 即插即用，替代纯硅器件
- 最高结温 T_{vjmax} = 175°C
- 符合 JEDEC 目标应用要求
- 无铅镀层；符合RoHS标准
- 完整的产品品类和 PSpice 模型： http://www.infineon.com/igbt/

Lead-free

Green

Halogen-free

RoHS

潜在应用

- 工业开关电源
- 工业级不间断电源（UPS）
- 光伏组串逆变器
- 储能
- 充电器

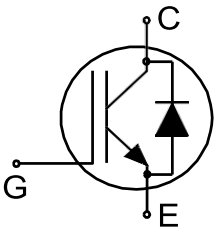
产品验证

- 根据 JEDEC20/22 相关测试的测试条件，符合上述应用要求

描述

封装引脚定义：

- 引脚G - 栅极
- 引脚 C & 背面 - 集电极
- 引脚 E - 发射极



Type	Package	Marking
IKW75N65SS5	PG-TO247-3	K75ESS5

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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			13.0		nH
Storage temperature	T_{stg}		-55		150	°C
Soldering temperature		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

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	limited by bondwire	$T_c = 25$ °C	80	A
			$T_c = 100$ °C	80	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}			300	A
Turn-off safe operating area		$V_{CE} \leq 650$ V, $t_p = 1$ µs, $T_{vj} \leq 175$ °C		300	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	395	W
			$T_c = 100$ °C	197	

表3 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	V_{CEsat}	$I_C = 75$ A, $V_{GE} = 15$ V	$T_{vj} = 25$ °C		1.35	1.7	V
			$T_{vj} = 125$ °C		1.55		
			$T_{vj} = 175$ °C		1.65		
Gate-emitter threshold voltage	V_{GEth}	$I_C = 0.75$ mA, $V_{CE} = V_{GE}$		3.2	4	4.8	V

（表格续下页……）

表 3　　（续） 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Zero gate-voltage collector current	I_{CES}	V_{CE} = 650 V, V_{GE} = 0 V	T_{vj} = 25 °C			1900	µA
			T_{vj} = 175 °C		3000		
Zero gate-voltage collector current	I_{CES}	V_{CE} = 480 V, V_{GE} = 0 V	T_{vj} = 25 °C			50	µA
Gate-emitter leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = 20 V				100	nA
Transconductance	g_{fs}	I_C = 75 A, V_{CE} = 20 V			100		S
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 250 kHz			4000		pF
Output capacitance	C_{oes}	V_{CE} = 25 V, V_{GE} = 0 V, f = 250 kHz			785		pF
Reverse transfer capacitance	C_{res}	V_{CE} = 25 V, V_{GE} = 0 V, f = 250 kHz			15		pF
Gate charge	Q_G	I_C = 75 A, V_{GE} = 15 V, V_{CC} = 520 V			164		nC
Turn-on delay time	$t_{d(on)}$	V_{CC} = 400 V, V_{GE} = 0/15 V, R_{Gon} = 5.6 Ω, R_{Goff} = 5.6 Ω, L_σ = 30 nH, C_σ = 30 pF	T_{vj} = 25 °C, I_C = 75 A		22		ns
			T_{vj} = 25 °C, I_C = 37.5 A		21		
			T_{vj} = 150 °C, I_C = 75 A		22		
			T_{vj} = 150 °C, I_C = 37.5 A		20		
Rise time (inductive load)	t_r	V_{CC} = 400 V, V_{GE} = 0/15 V, R_{Gon} = 5.6 Ω, R_{Goff} = 5.6 Ω, L_σ = 30 nH, C_σ = 30 pF	T_{vj} = 25 °C, I_C = 75 A		13		ns
			T_{vj} = 25 °C, I_C = 37.5 A		8		
			T_{vj} = 150 °C, I_C = 75 A		15		
			T_{vj} = 150 °C, I_C = 37.5 A		8		
Turn-off delay time	$t_{d(off)}$	V_{CC} = 400 V, V_{GE} = 0/15 V, R_{Gon} = 5.6 Ω, R_{Goff} = 5.6 Ω, L_σ = 30 nH, C_σ = 30 pF	T_{vj} = 25 °C, I_C = 75 A		145		ns
			T_{vj} = 25 °C, I_C = 37.5 A		155		
			T_{vj} = 150 °C, I_C = 75 A		168		
			T_{vj} = 150 °C, I_C = 37.5 A		195		

（表格续下页……）

表 3　　（续） 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Fall time (inductive load)	t_f	V_{CC} = 400 V, V_{GE} = 0/15 V, R_{Gon} = 5.6 Ω, R_{Goff} = 5.6 Ω, L_σ = 30 nH, C_σ = 30 pF	T_{vj} = 25 °C, I_C = 75 A		21		ns
			T_{vj} = 25 °C, I_C = 37.5 A		26		
			T_{vj} = 150 °C, I_C = 75 A		24		
			T_{vj} = 150 °C, I_C = 37.5 A		33		
Turn-on energy	E_{on}	V_{CC} = 400 V, V_{GE} = 0/15 V, R_{Gon} = 5.6 Ω, R_{Goff} = 5.6 Ω, L_σ = 30 nH, C_σ = 30 pF	T_{vj} = 25 °C, I_C = 75 A		0.45		mJ
			T_{vj} = 25 °C, I_C = 37.5 A		0.2		
			T_{vj} = 150 °C, I_C = 75 A		0.57		
			T_{vj} = 150 °C, I_C = 37.5 A		0.25		
Turn-off energy	E_{off}	V_{CC} = 400 V, V_{GE} = 0/15 V, R_{Gon} = 5.6 Ω, R_{Goff} = 5.6 Ω, L_σ = 30 nH, C_σ = 30 pF	T_{vj} = 25 °C, I_C = 75 A		0.75		mJ
			T_{vj} = 25 °C, I_C = 37.5 A		0.42		
			T_{vj} = 150 °C, I_C = 75 A		1.24		
			T_{vj} = 150 °C, I_C = 37.5 A		0.75		
Total switching energy	E_{ts}	V_{CC} = 400 V, V_{GE} = 0/15 V, R_{Gon} = 5.6 Ω, R_{Goff} = 5.6 Ω, L_σ = 30 nH, C_σ = 30 pF	T_{vj} = 25 °C, I_C = 75 A		1.2		mJ
			T_{vj} = 25 °C, I_C = 37.5 A		0.62		
			T_{vj} = 150 °C, I_C = 75 A		1.81		
			T_{vj} = 150 °C, I_C = 37.5 A		1		
IGBT thermal resistance, junction-case	$R_{th(j-c)}$					0.38	K/W
Operating junction temperature	T_{vj}			-40		175	°C

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}	$T_{vj} \geq 25$ °C		650	V
Diode forward current, limited by T_{vjmax}	I_F	limited by bondwire	$T_c = 25$ °C	80	A
			$T_c = 100$ °C	57	
Diode pulsed current, t_p limited by T_{vjmax} 1)	I_{Fpulse}			225	A

1) 脉冲电流水平取决于二极管芯片的 T_{vj}，另见图“最大脉冲电流与结温的关系”

表5 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode forward voltage	V_F	$I_F = 60$ A	$T_{vj} = 25$ °C		1.35	1.5	V
			$T_{vj} = 125$ °C		1.55		
			$T_{vj} = 175$ °C		1.65		
Diode thermal resistance, junction-case	$R_{th(j-c)}$					0.68	K/W
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%。

除非另有规定，*电气特性均为 $T_{vj} = 25$°C。*

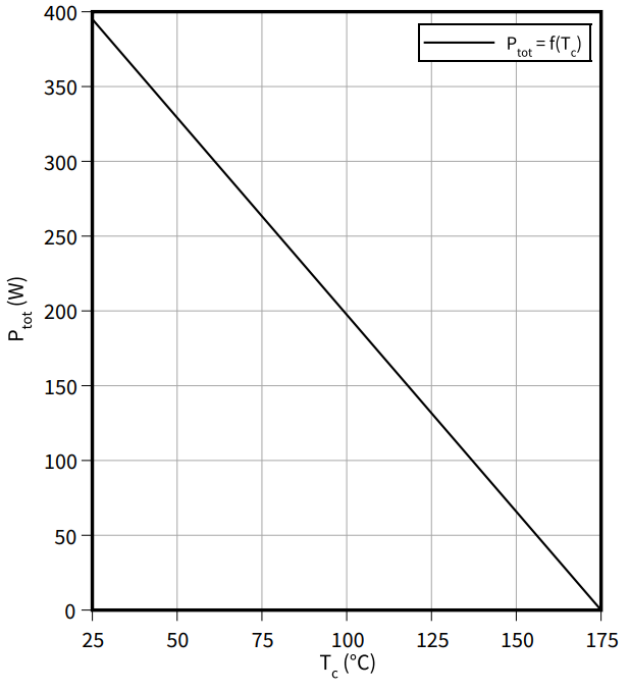
动态测试电路，寄生电感 L_σ，寄生电容 C_σ，来自图E。能量损失包括“拖尾”和二极管反向恢复。

4 特性图

Power dissipation as a function of case temperature

$P_{tot} = f(T_c)$

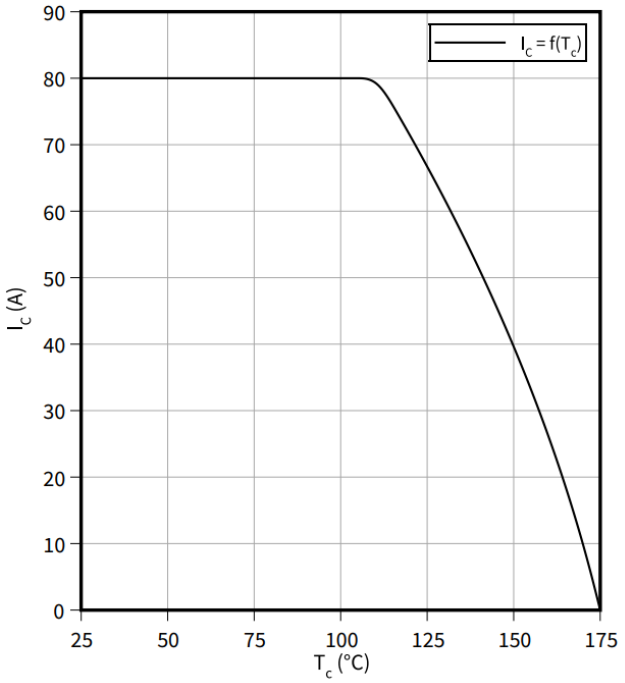
$T_{vj} \leq 175\ °C$



Collector current as a function of case temperature

$I_C = f(T_c)$

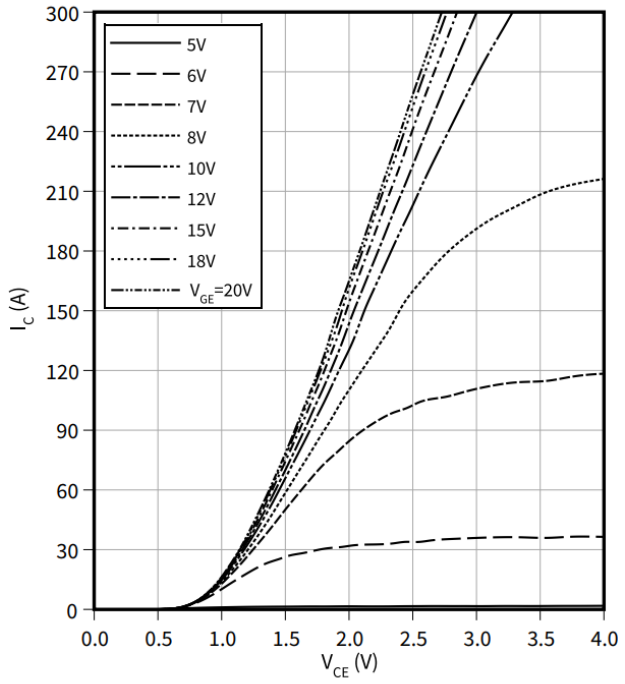
$T_{vj} \leq 175\ °C, V_{GE} \geq 15\ V$



Typical output characteristic

$I_C = f(V_{CE})$

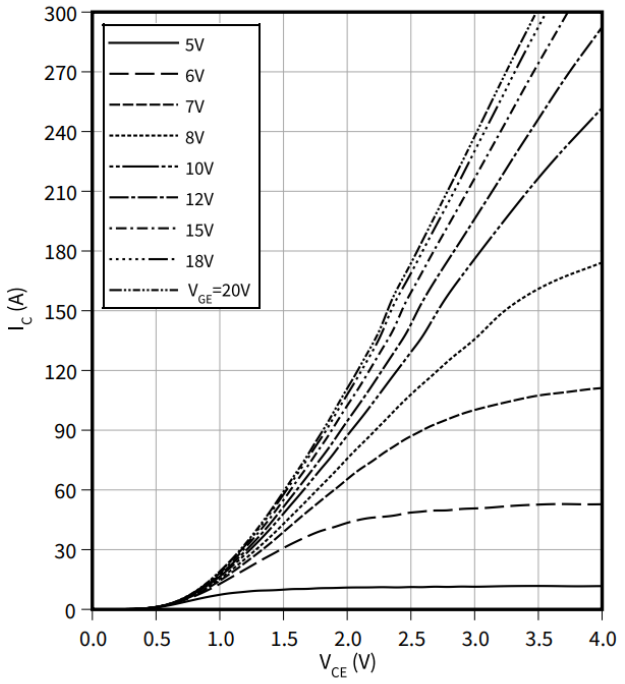
$T_{vj} = 25\ °C$



Typical output characteristic

$I_C = f(V_{CE})$

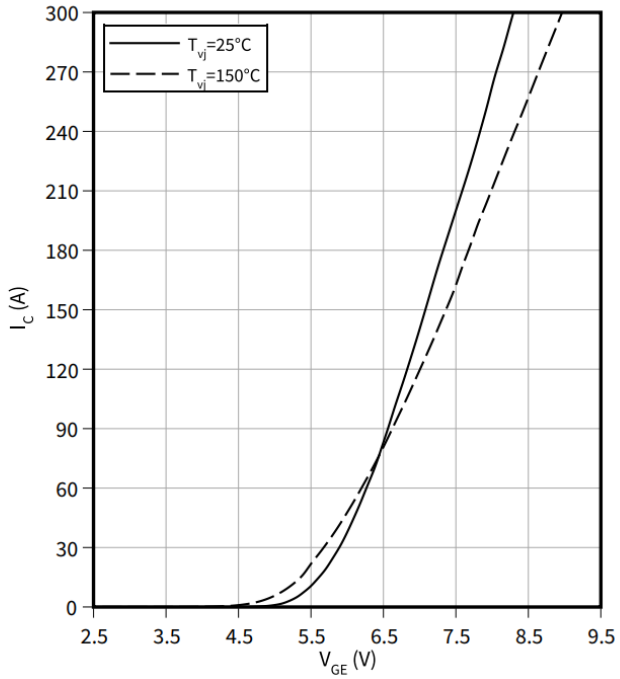
$T_{vj} = 150\ °C$



Typical transfer characteristic

$I_C = f(V_{GE})$

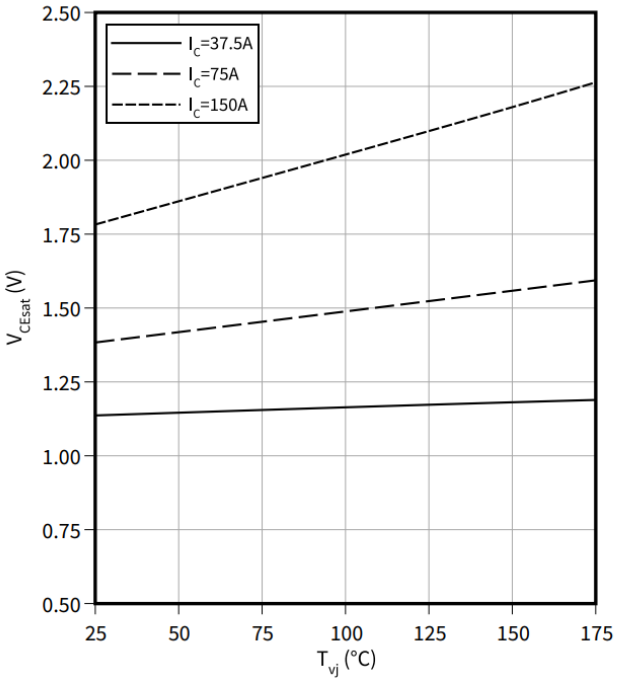
$V_{CE} = 20$ V



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

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

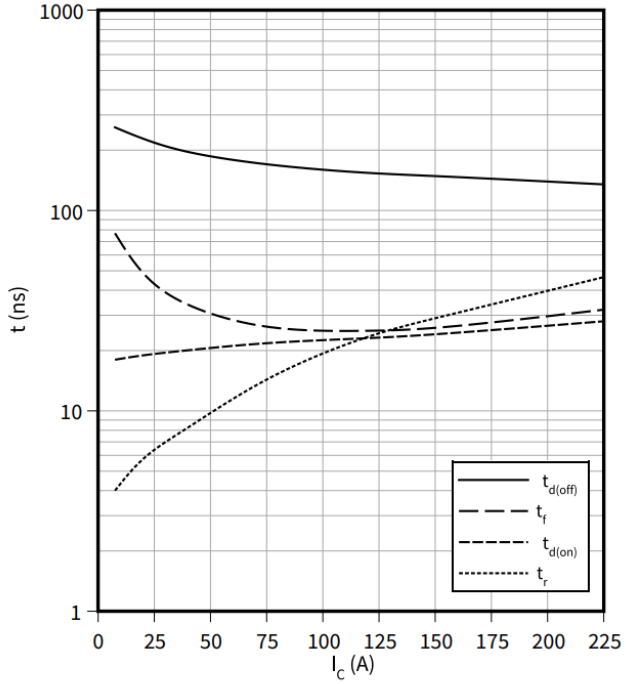
$V_{GE} = 15$ V



Typical switching times as a function of collector current

$t = f(I_C)$

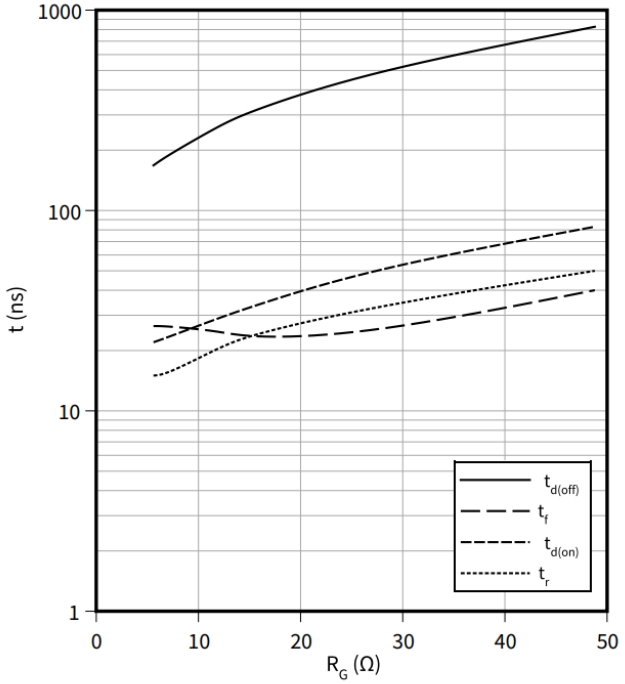
$V_{CC} = 400$ V, $T_{vj} = 150$ °C, $V_{GE} = 0/15$ V, $R_G = 5.6\ \Omega$



Typical switching times as a function of gate resistor

$t = f(R_G)$

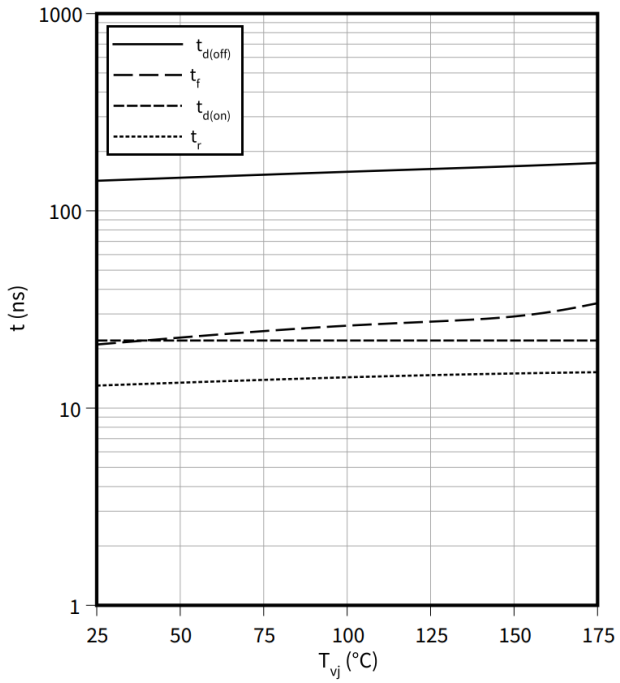
$I_C = 75$ A, $V_{CC} = 400$ V, $T_{vj} = 150$ °C, $V_{GE} = 0/15$ V



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

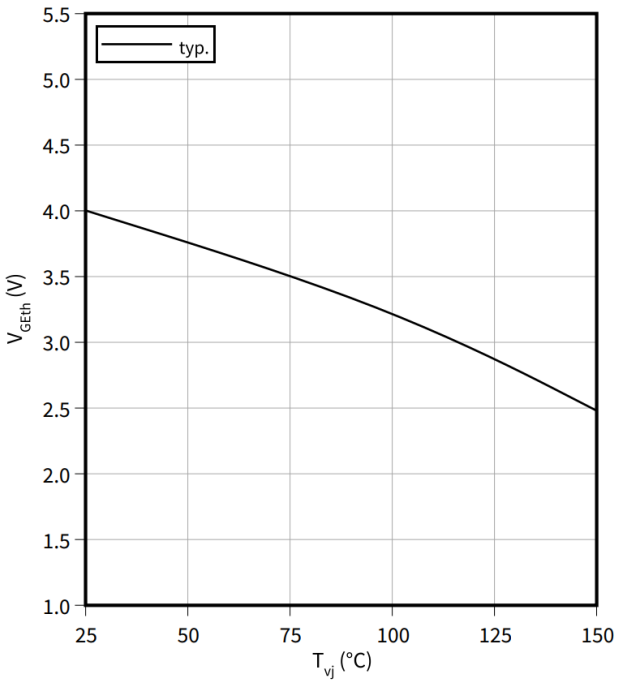
I_C = 75 A, V_{CC} = 400 V, V_{GE} = 0/15 V, R_G = 5.6 Ω



Gate-emitter threshold voltage as a function of junction temperature

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

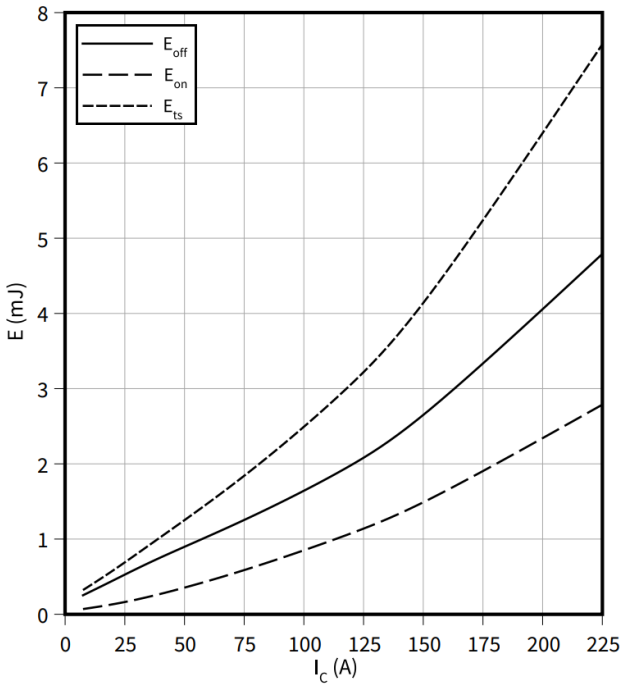
I_C = 0.75 mA



Typical switching energy losses as a function of collector current

$E = f(I_C)$

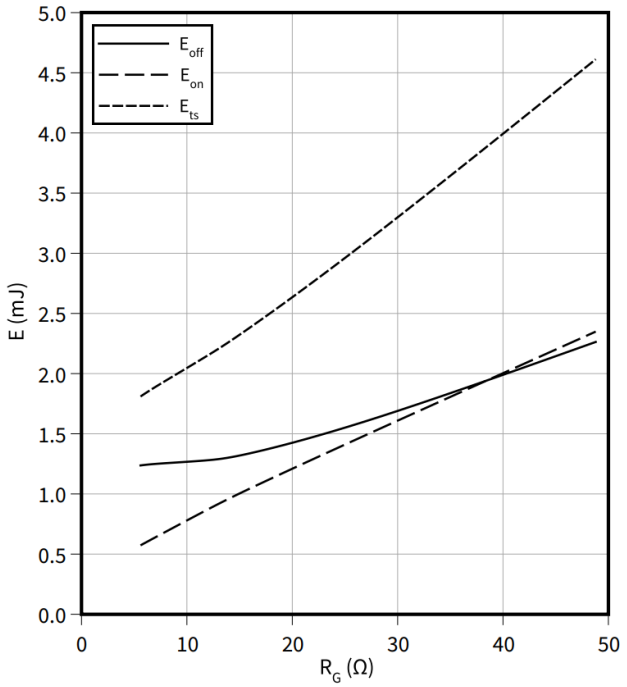
V_{CC} = 400 V, T_{vj} = 150 °C, V_{GE} = 0/15 V, R_G = 5.6 Ω



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

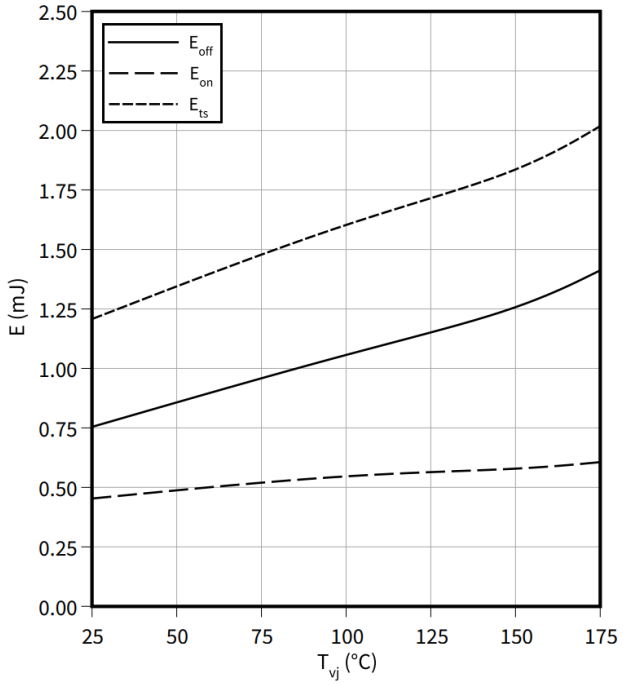
I_C = 75 A, V_{CC} = 400 V, T_{vj} = 150 °C, V_{GE} = 0/15 V



Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

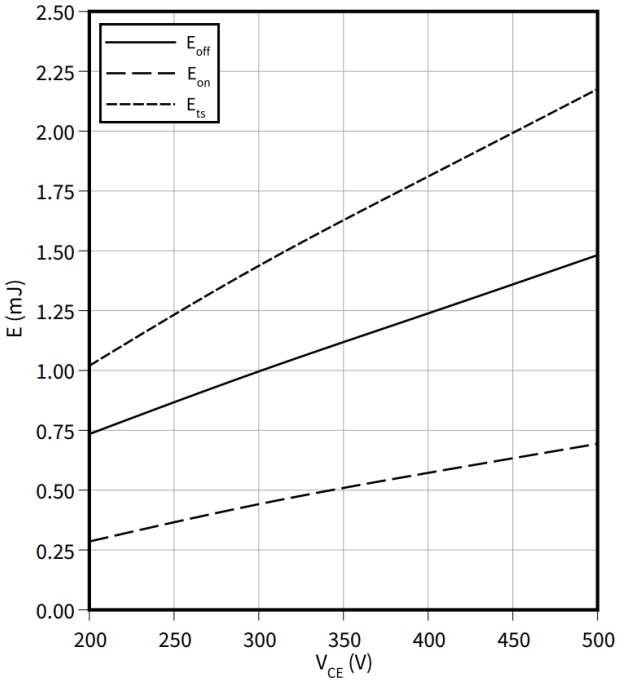
$I_C = 75\ A$, $V_{CC} = 400\ V$, $V_{GE} = 0/15\ V$, $R_G = 5.6\ \Omega$



Typical switching energy losses as a function of collector emitter voltage

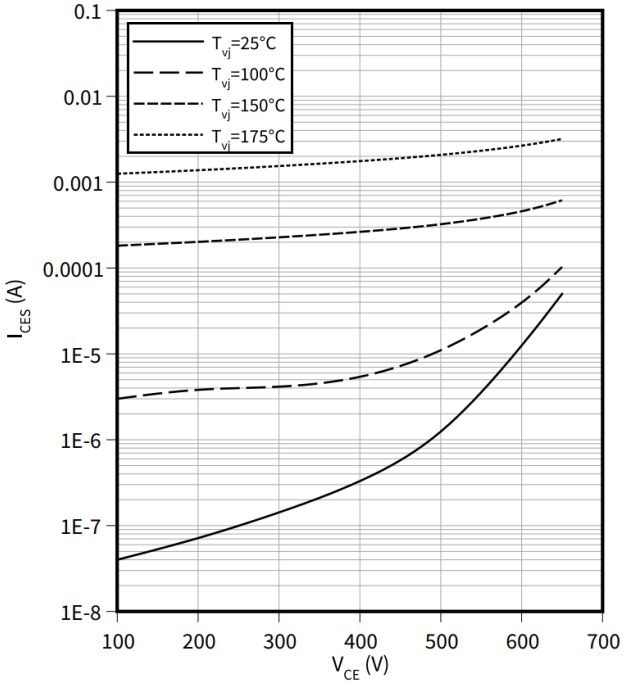
$E = f(V_{CE})$

$I_C = 75\ A$, $T_{vj} = 150\ °C$, $V_{GE} = 0/15\ V$, $R_G = 5.6\ \Omega$



Typ. reverse current vs. reverse voltage as a function of Tvj

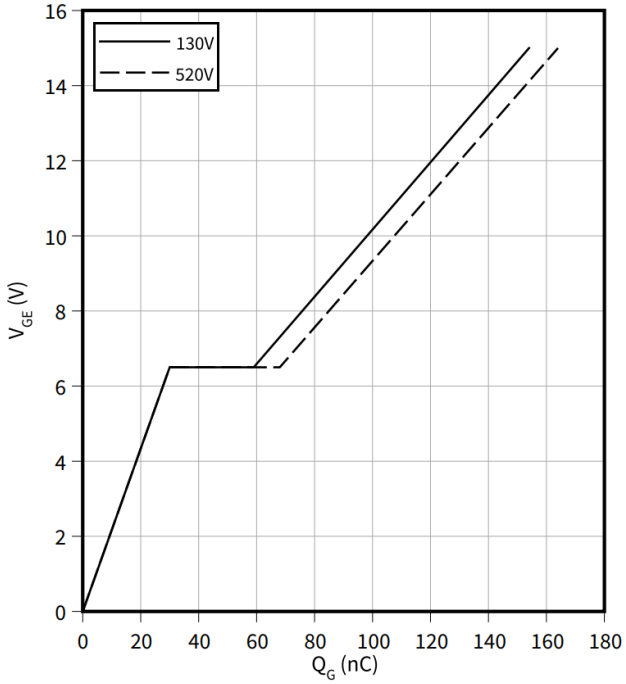
$I_{CES} = f(V_{CE})$



Typical gate charge

$V_{GE} = f(Q_G)$

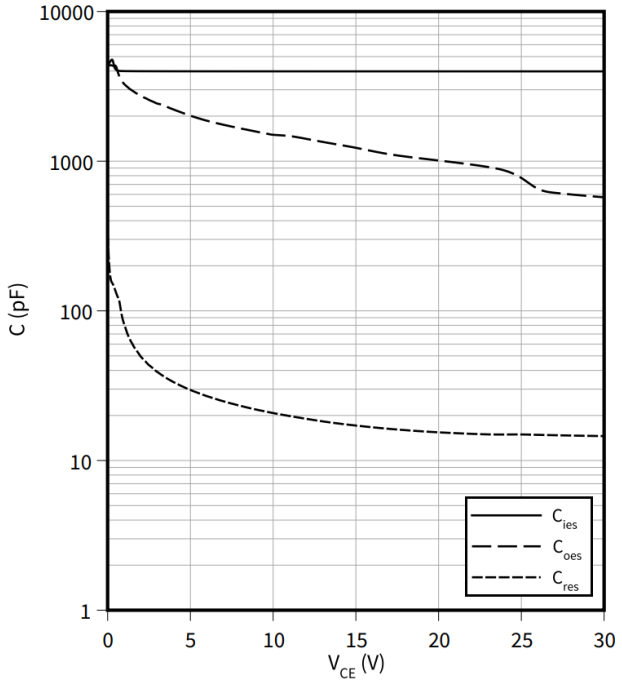
$I_C = 75\ A$



Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE})$

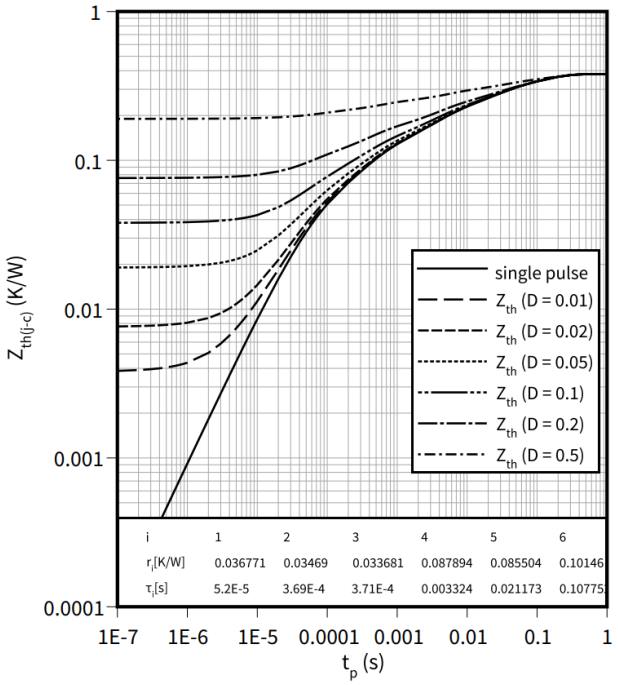
$f = 250\ kHz, V_{GE} = 0\ V$



IGBT transient thermal impedance as a function of pulse width

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

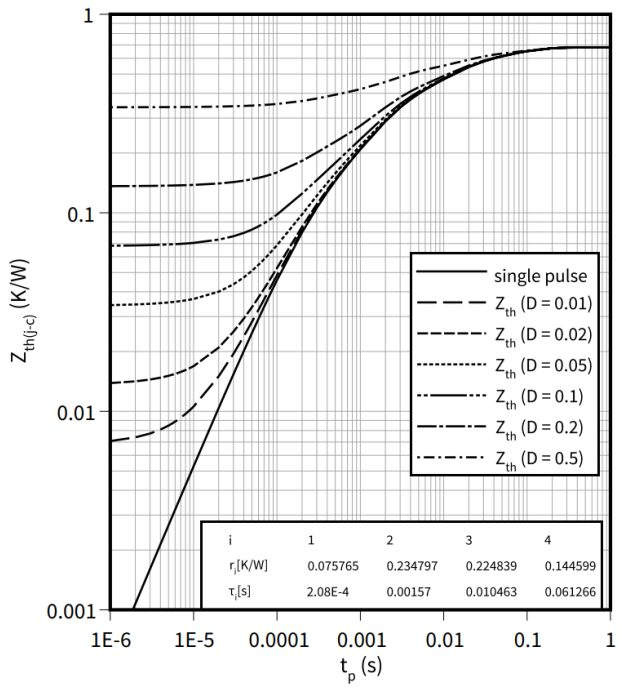
$D = t_p/T$



Diode transient thermal impedance as a function of pulse width

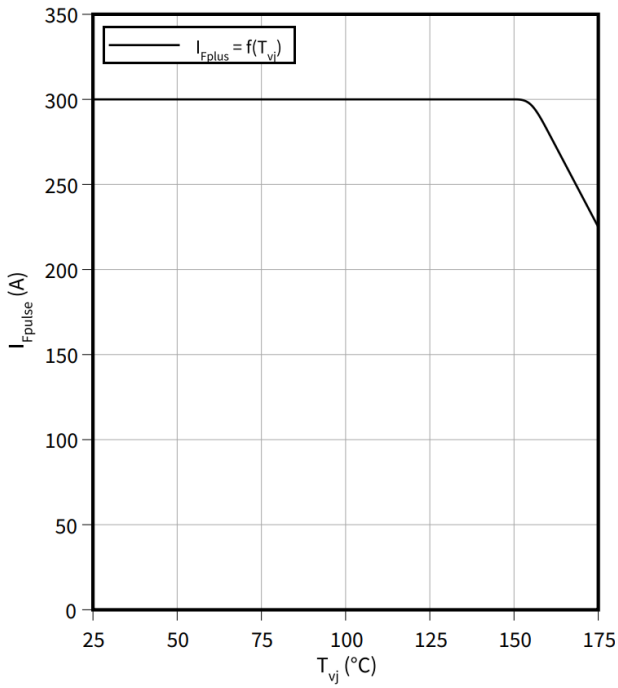
$Z_{th(j-c)} = f(t_p)$

$D = t_p/T$



Maximum pulse current as a function of junction temperature

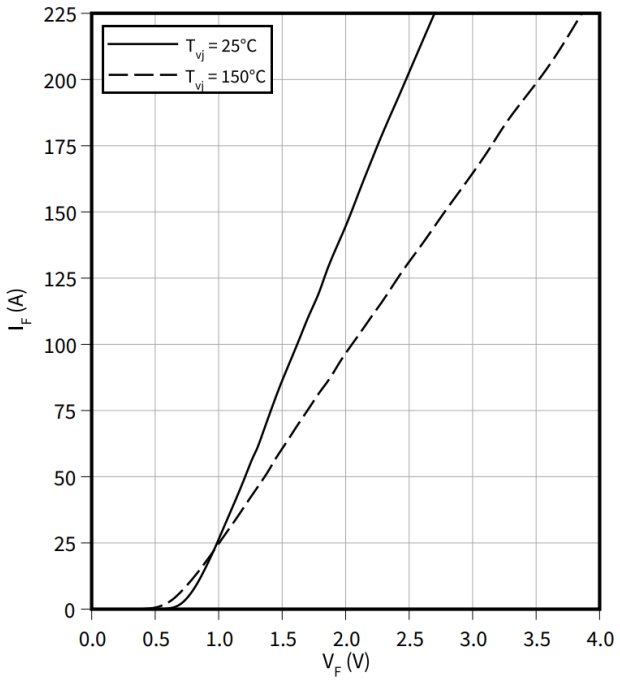
$I_{Fpulse} = f(T_{vj})$



4 特性图

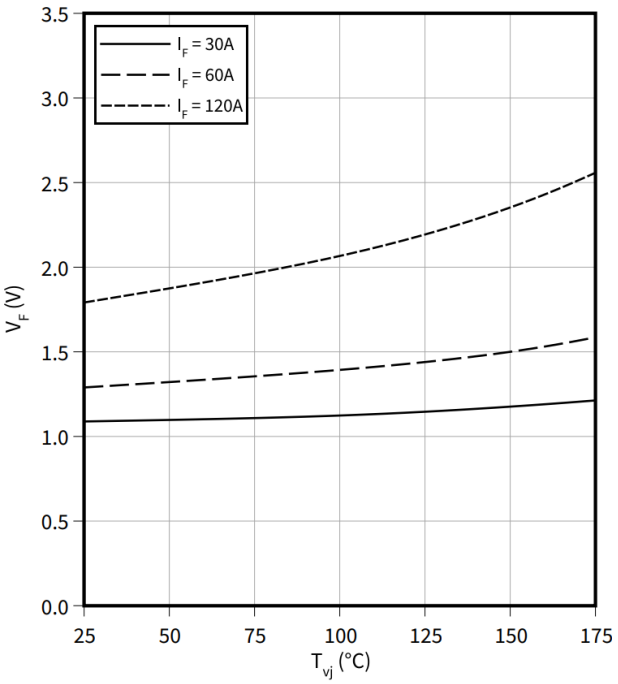
Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



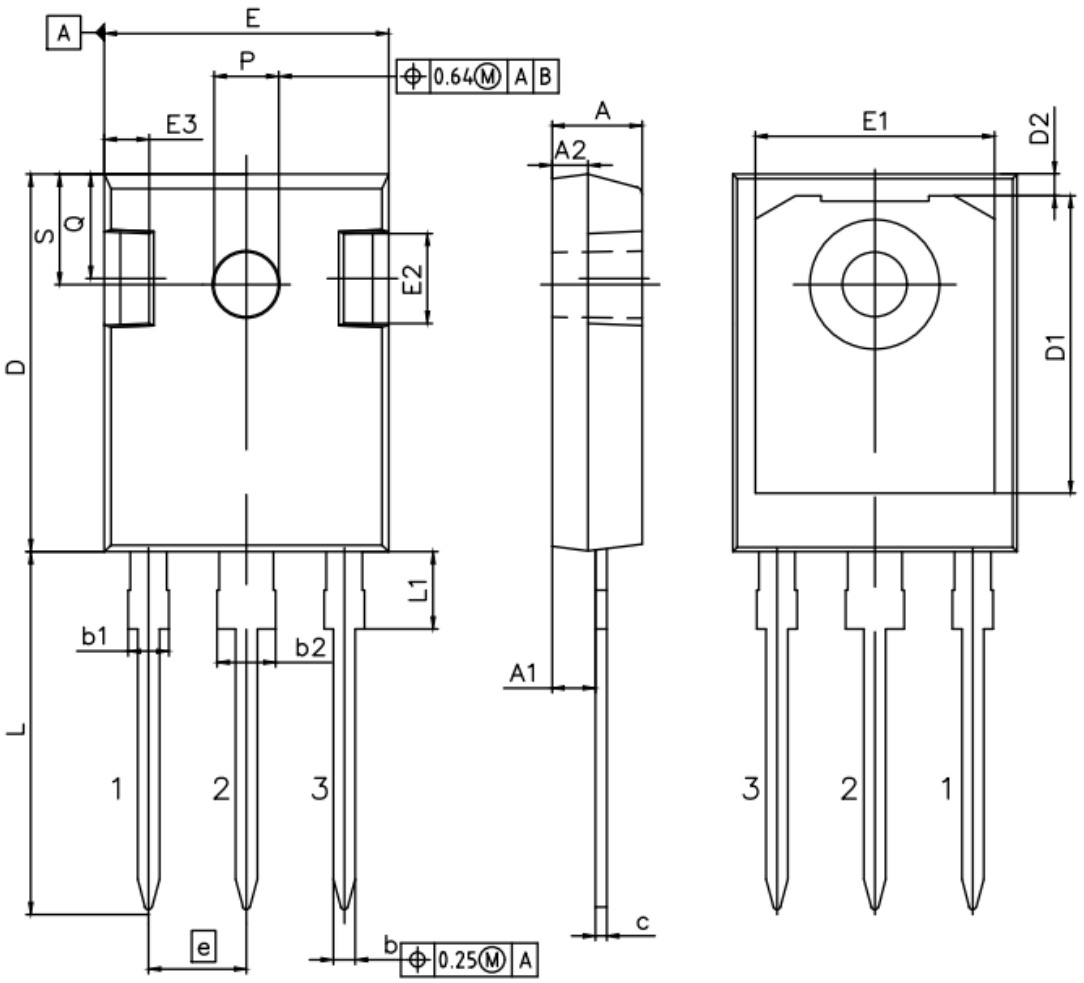
Typical diode forward voltage as a function of junction temperature

$V_F = f(T_{vj})$



5 封装外形

Package Drawing PG-TO247-3



DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	4.70	5.30
A1	2.20	2.60
A2	1.50	2.50
b	1.00	1.40
b1	1.60	2.41
b2	2.57	3.43
c	0.38	0.89
D	20.70	21.50
D1	13.08	17.65
D2	0.51	1.35
E	15.50	16.30
E1	12.38	14.15
E2	3.40	5.10
E3	1.00	2.60
e	5.44	
L	19.80	20.40
L1	3.85	4.50
P	3.50	3.70
Q	5.35	6.25
S	6.04	6.30

DOCUMENT NO.
Z8B00003327

REVISION
06

SCALE 3:1
0 1 2 3 4 5mm

EUROPEAN PROJECTION

ISSUE DATE
25.07.2018

图 1

6 测试条件

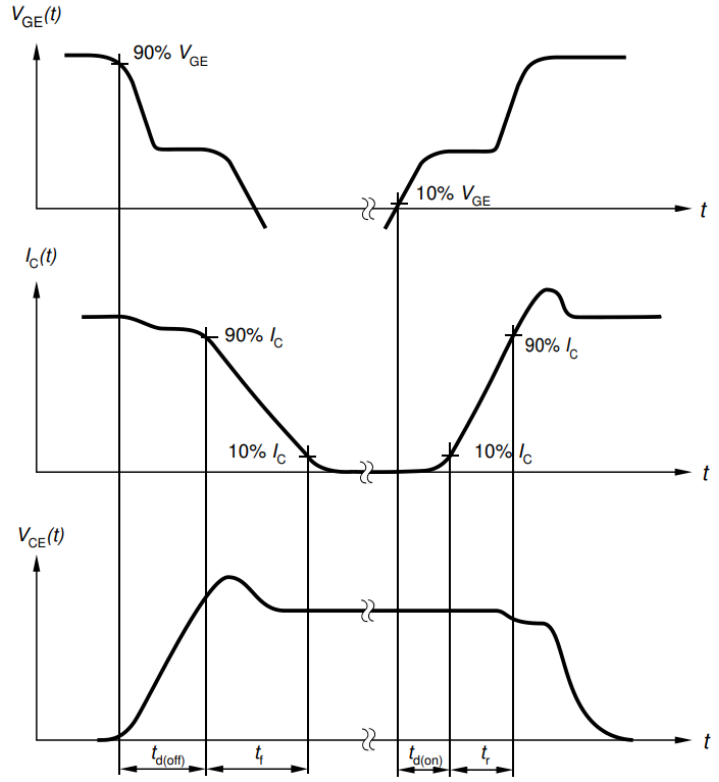


Figure A. **Definition of switching times**

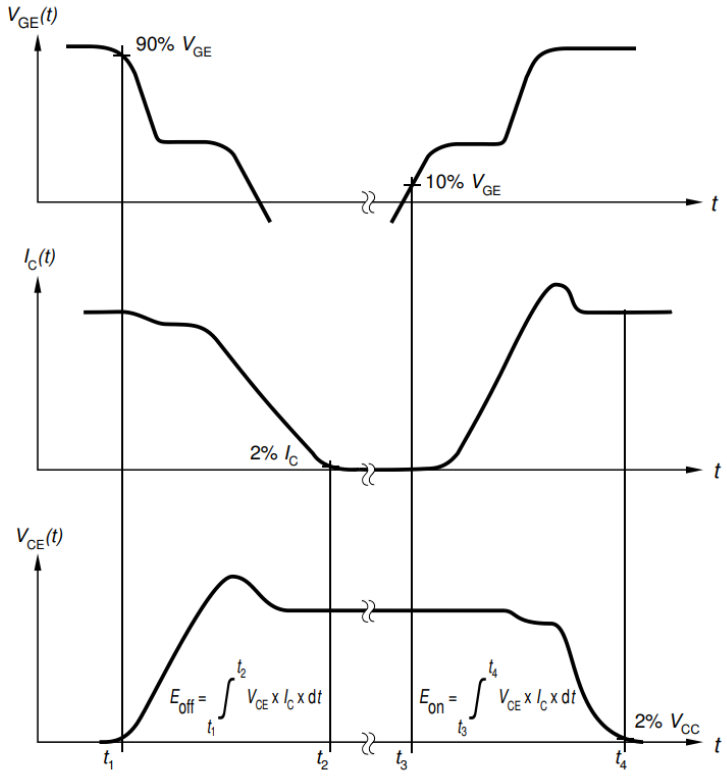


Figure B. **Definition of switching losses**

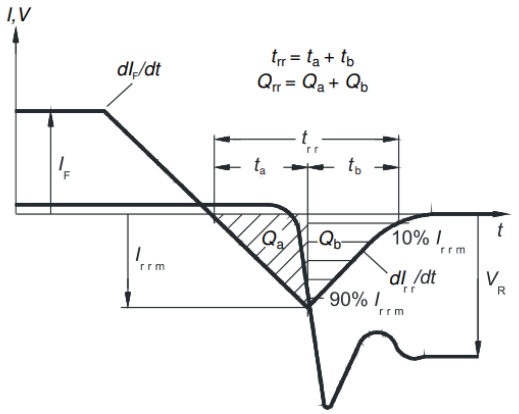


Figure C. **Definition of diode switching characteristics**

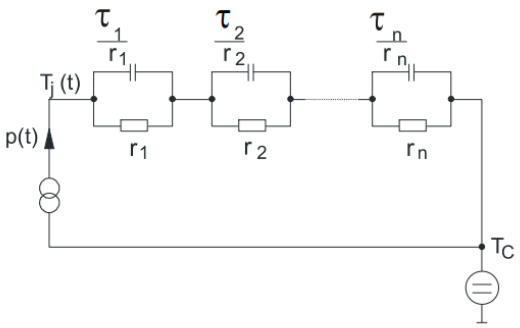


Figure D. **Thermal equivalent circuit**

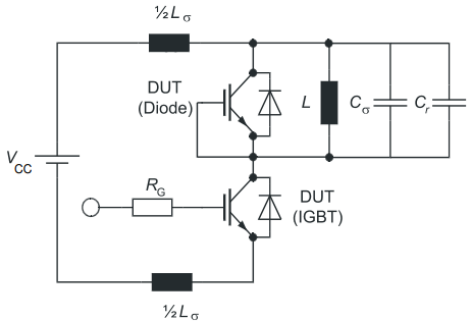


Figure E. **Dynamic test circuit**
Parasitic inductance L_σ,
parasitic capacitor C_σ,
relief capacitor C_r,
(only for ZVT switching)

图 2

修订记录

Document revision	Date of release	Description of changes
V1.1	2020-03-20	Preliminary Data Sheet
V2.1	2020-07-27	Final Data Sheet
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	2022-09-22	Rename of product family name from “Hybrid CoolSiC™ IGBT” to “CoolSiC™ hybrid discrete”

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版本 **2025-09-16**

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