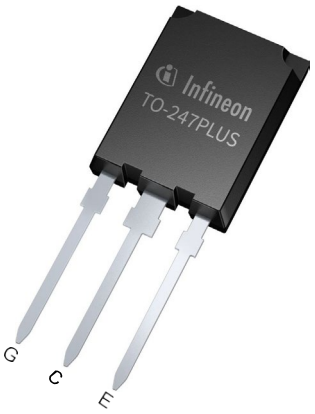
最终数据手册

英飞凌 耐短路 750V EDT2 IGBT 与快速软恢复二极管封装

特性



- V_{CE} = 750 V
- I_C = 120 A
- 750V集电极-发射极阻断电压能力
- 适用于 470 V V_{DC}系统，并增加了 400 V V_{DC} 系统的过压裕量
- 极低 V_{CEsat} = 1.3 V（typ.），I_{Cnom}= 120 A，25°C
- 短路耐受时间 t_{sc} = 5 µs（V_{CE} = 470 V、V_{GE} = 15 V）
- 短路条件下的自限电流
- 正温度系数和非常紧密的参数分布，易于并联
- 可直接替换上一代器件 I_C = 120 A，T_c = 100°C
- 优异的并联均流能力
- 平滑的开关特性，低EMI特征
- 低栅极电荷 Q_G
- 简单的栅极驱动器设计
- 配备快速软恢复发射极控制二极管 (Emcon3)
- TO247PLUS 封装，爬电距离高达 6.6 mm
- 高可靠性

AEC Qualified

Halogen-free

RoHS

Lead-free

Green

潜在应用

- 电动汽车牵引逆变器
- DC母线放电开关
- 汽车辅助驱动

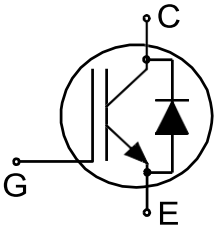
产品验证

- 车规级应用认证。
- 符合 AEC-Q101 标准

描述

封装引脚定义：

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



Type	Package	Marking
AIKQ120N75CP2	PG-TO247-3-U01	AKQ12FCP

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
Thermal resistance, junction-ambient	$R_{th(j-a)}$				40	K/W
IGBT thermal resistance, junction-case	$R_{th(j-c)}$			0.17	0.22	K/W
Diode thermal resistance, junction-case	$R_{th(j-c)}$			0.31	0.4	K/W

2 IGBT

表 2 最大额定值

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CE}			750	V
DC collector current, limited by T_{vjmax}	I_C		T_c = 25 °C	150	A
			T_c = 100 °C	120	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}			360	A
Turn-off safe operating area		V_{CE} ≤ 750 V, t_p = 1 µs, T_{vj} ≤ 175 °C		360	A
Gate-emitter voltage	V_{GE}			±20	V
Transient gate-emitter voltage	V_{GE}	t_p < 0.1 µs, D < 0.01		±30	V
Short-circuit withstand time	t_{SC}	V_{CC} ≤ 470 V, V_{GE}=15 V, Allowed number of short circuits < 1000, Time between short circuits ≥ 1.0 s, T_{vj} = 25 °C		5	µs
Power dissipation	P_{tot}		T_c = 25 °C	682	W
			T_c = 100 °C	341	

表3　　特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	V_{CEsat}	I_C = 120 A, V_{GE}=15 V	T_{vj} = 25 °C	1.2	1.3	1.5	V
			T_{vj} = 175 °C		1.53		
Gate-emitter threshold voltage	V_{GEth}	I_C = 1.6 mA, V_{CE} = V_{GE}		5.2	5.8	6.4	V
Zero gate-voltage collector current	I_{CES}	V_{CE} = 750 V, V_{GE}=0 V	T_{vj}=25 °C			200	µA
			T_{vj}=175 °C		4000		
Gate-emitter leakage current	I_{GES}	V_{CE}=0 V, V_{GE}=20 V				100	nA
Transconductance	g_{fs}	I_C = 120 A, V_{CE}=20 V			90		S
Short-circuit collector current	I_{SC}	V_{CC} ≤ 470 V, V_{GE}=15 V, t_{SC} ≤ 5 µs, Allowed number of short circuits < 1000, Time between short circuits ≥ 1.0 s, T_{vj}=25 °C	T_{vj} = 25 °C		750		A
Input capacitance	C_{ies}	V_{CE}=25 V, V_{GE}=0 V, f=100 kHz			13100		pF
Output capacitance	C_{oes}	V_{CE}=25 V, V_{GE}=0 V, f=100 kHz			337		pF
Reverse transfer capacitance	C_{res}	V_{CE}=25 V, V_{GE}=0 V, f=100 kHz			59		pF
Gate charge	Q_G	V_{CC} = 600 V, I_C = 120 A			731		nC
Turn-on delay time	$t_{d(on)}$	V_{GE} = -8/15 V, $R_{G(on)}$ = 5 Ω, $R_{G(off)}$ = 5 Ω, L_σ=50 nH, C_σ=30 pF	T_{vj} = 25 °C, I_C = 120 A		71		ns
			T_{vj} = 175 °C, I_C = 120 A		50		
Rise time (inductive load)	t_r	V_{GE} = -8/15 V, $R_{G(on)}$ = 5 Ω, $R_{G(off)}$ = 5 Ω, L_σ=50 nH, C_σ=30 pF	T_{vj} = 25 °C, I_C = 120 A		69		ns
			T_{vj} = 175 °C, I_C = 120 A		68		
Turn-off delay time	$t_{d(off)}$	V_{GE} = -8/15 V, $R_{G(on)}$ = 5 Ω, $R_{G(off)}$ = 5 Ω, L_σ=50 nH, C_σ=30 pF	T_{vj} = 25 °C, I_C = 120 A		244		ns
			T_{vj} = 175 °C, I_C = 120 A		226		
Fall time (inductive load)	t_f	V_{GE} = -8/15 V, $R_{G(on)}$ = 5 Ω, $R_{G(off)}$ = 5 Ω, L_σ=50 nH, C_σ=30 pF	T_{vj} = 25 °C, I_C = 120 A		50.5		ns
			T_{vj} = 175 °C, I_C = 120 A		67		

（表格续下页……）

表 3 （续） 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Turn-on energy[1)]	E_{on}	V_{GE} = -8/15 V, $R_{G(on)}$ = 5 Ω, $R_{G(off)}$ = 5 Ω, L_σ=50 nH, C_σ=30 pF	T_{vj} = 25 °C, I_C = 120 A		6.82		mJ
			T_{vj} = 175 °C, I_C = 120 A		7.3		
Turn-off energy	E_{off}	V_{GE} = -8/15 V, $R_{G(on)}$ = 5 Ω, $R_{G(off)}$ = 5 Ω, L_σ=50 nH, C_σ=30 pF	T_{vj} = 25 °C, I_C = 120 A		3.8		mJ
			T_{vj} = 175 °C, I_C = 120 A		4.7		
Total switching energy	E_{ts}	V_{GE} = -8/15 V, $R_{G(on)}$ = 5 Ω, $R_{G(off)}$ = 5 Ω, L_σ=50 nH, C_σ=30 pF	T_{vj} = 25 °C, I_C = 120 A		10.3		mJ
			T_{vj} = 175 °C, I_C = 120 A		12.1		
Operating junction temperature	T_{vj}			-40		175	°C

1) 包括反向恢复电流引起的 IGBT 损耗

3 二极管

表4 最大额定值

Parameter	Symbol	Note or test condition		Values	Unit
Diode forward current, limited by T_{vjmax}	I_F		T_c = 25 °C	150	A
			T_c = 100 °C	120	
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpulse}			360	A
Power dissipation	P_{tot}		T_c = 25 °C	375	W
			T_c = 100 °C	170	

表5 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode forward voltage	V_F	I_F = 120 A	T_{vj}=25 °C		1.7	1.95	V
			T_{vj}=175 °C		1.74		

（表格续下页……）

表 5 （续） 特征值

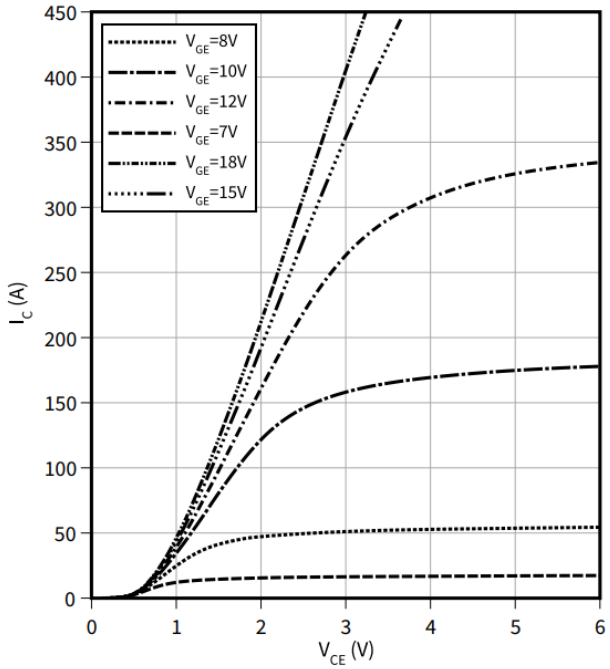
Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode reverse recovery charge	Q_{rr}	V_R < 470 V, $R_{G(on)}$=4.8 Ω	T_{vj} = 25 °C, I_F = 120 A, $-di_F/dt$ = 1070 A/µs		3.58		µC
			T_{vj} = 175 °C, I_F = 120 A, $-di_F/dt$ = 1055 A/µs		5.28		
Diode peak reverse recovery current	I_{rrm}	V_R < 470 V, $R_{G(on)}$=4.8 Ω	T_{vj} = 25 °C, I_F = 120 A, $-di_F/dt$ = 1070 A/µs		33		A
			T_{vj} = 175 °C, I_F = 120 A, $-di_F/dt$ = 1055 A/µs		43		
Reverse recovery energy	E_{rec}	V_R < 470 V, V_{GE} = -8/15 V, $R_{G(on)}$=4.8 Ω, L_σ = 50 nH, C_σ = 30 pF	T_{vj} = 25 °C, I_F = 120 A, $-di_F/dt$ = 1070 A/µs		1.24		mJ
			T_{vj} = 175 °C, I_F = 120 A, $-di_F/dt$ = 1055 A/µs		1.61		
Operating junction temperature	T_{vj}			-40		175	°C

4 特性图

Typical output characteristic

$I_C = f(V_{CE})$

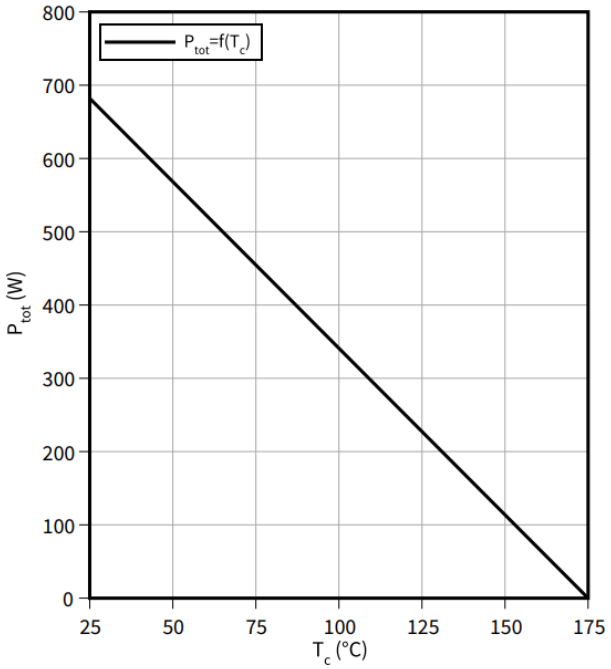
$T_{vj} = =175\ °C$



Power dissipation as a function of case temperature

$P_{tot} = f(T_c)$

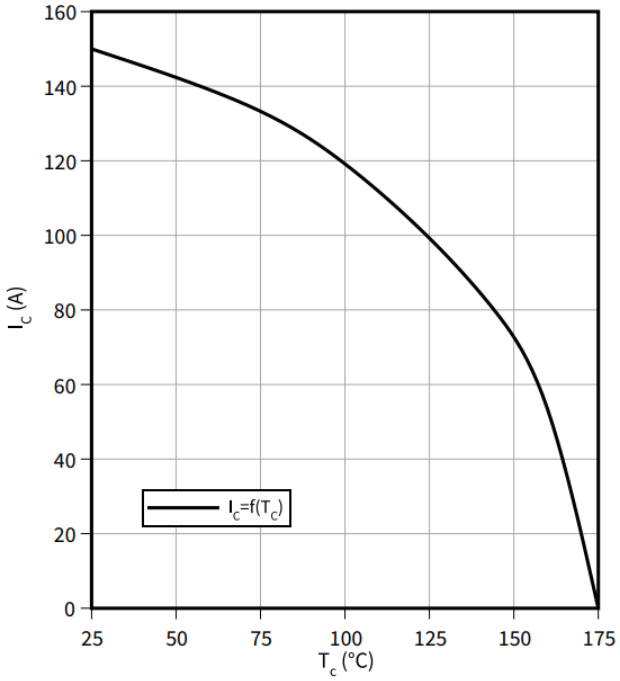
$T_{vj} \leq 175\ °C$



Collector current as a function of case temperature

$I_C = f(T_c)$

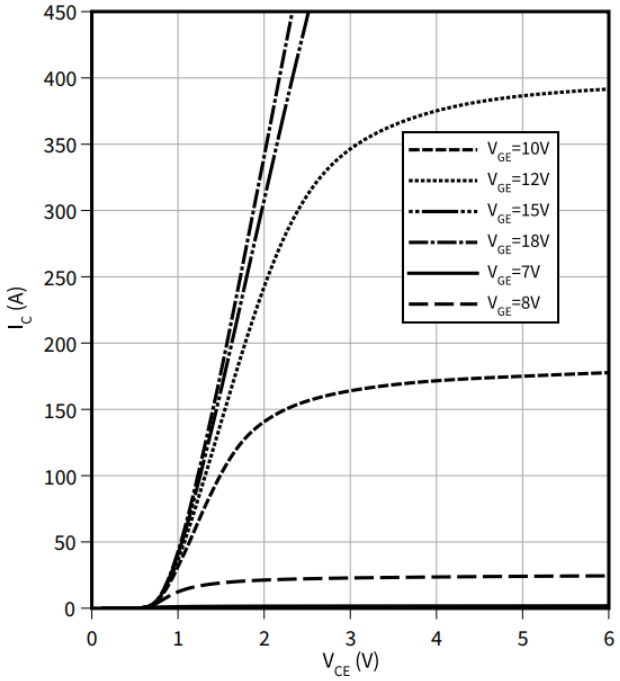
$T_{vj} \leq 175\ °C, V_{GE} = 15\ V$



Typical output characteristic

$I_C = f(V_{CE})$

$T_{vj} = 25\ °C$

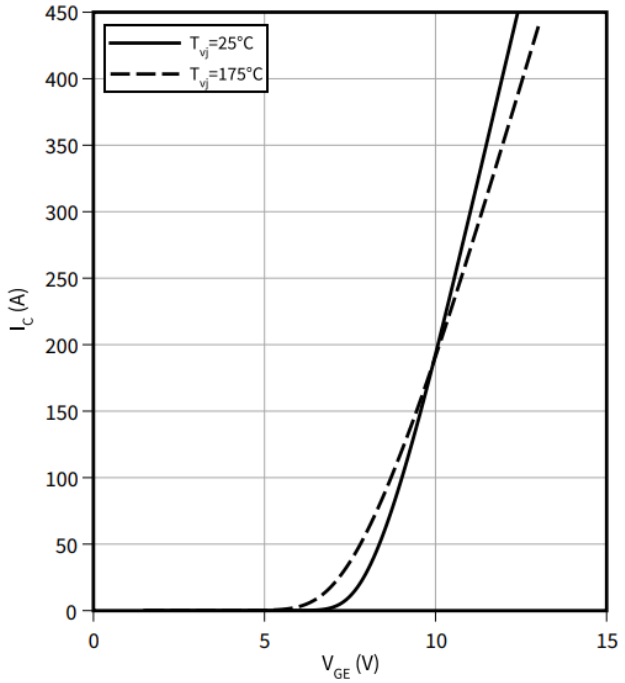


4 特性图

Typical transfer characteristic

$I_C = f(V_{GE})$

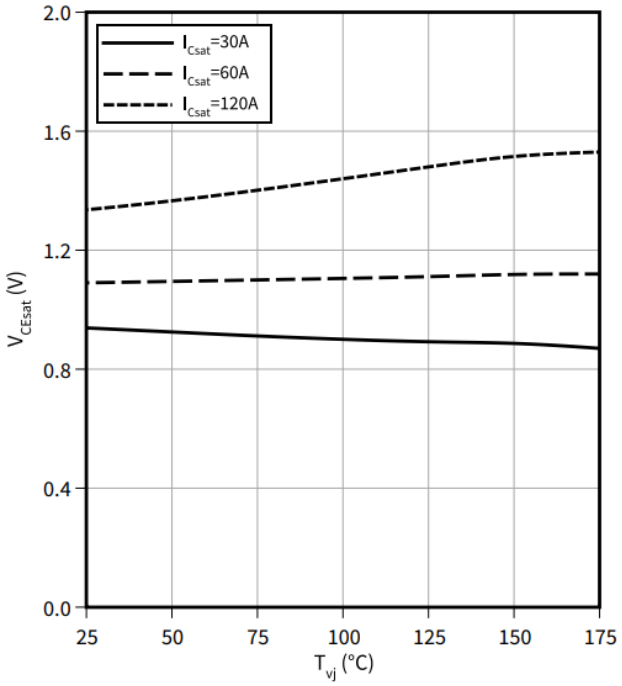
V_{CE} = 20 V



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

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

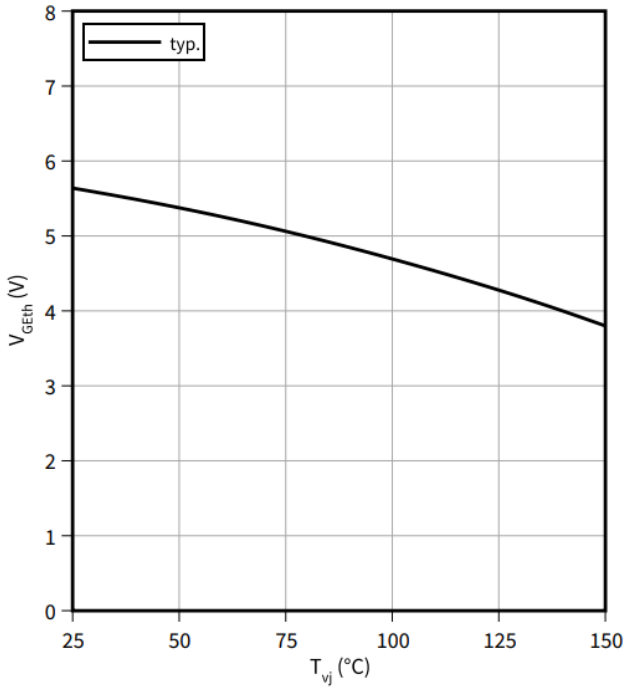
V_{GE} = 15 V



Typical Gate-emitter threshold voltage as a function of junction temperature

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

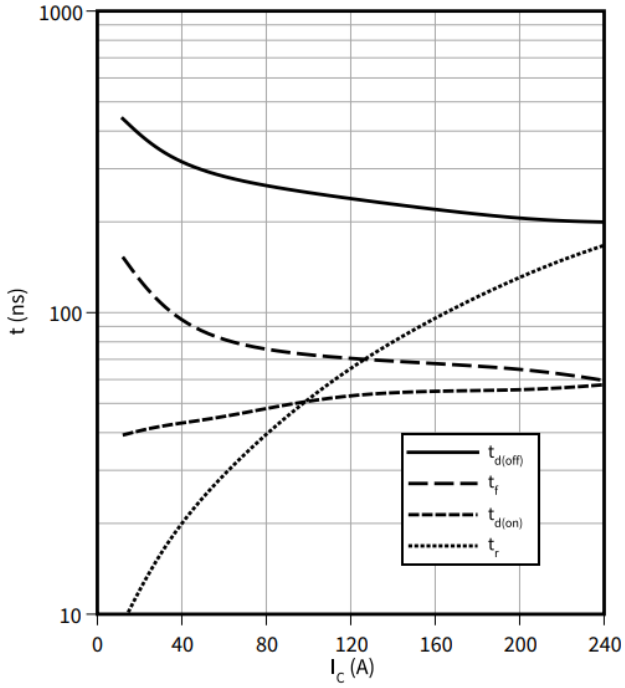
I_C = 1.60 mA



Typical switching times as a function of collector current

$t = f(I_C)$

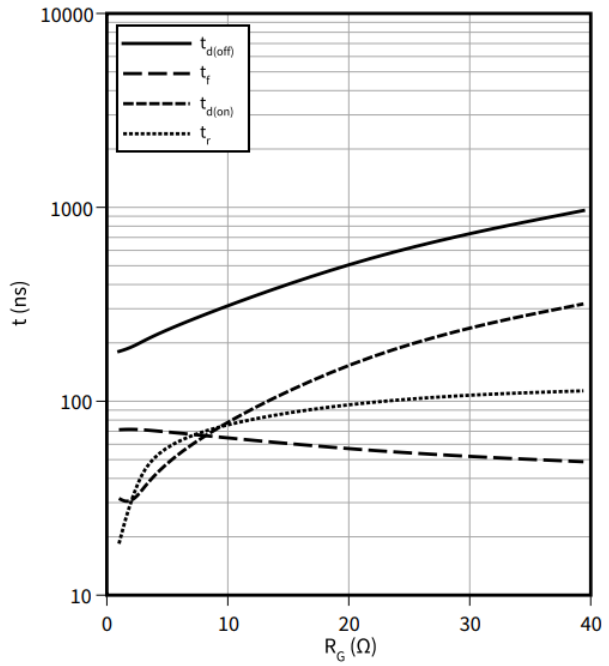
$R_{G(off)}$ = 5.0 Ω, V_{CE} = 470 V, T_{vj} = 175 °C, V_{GE} = -8/15 V, $R_{G(on)}$ = 5 Ω



Typical switching times as a function of gate resistor

$t = f(R_G)$

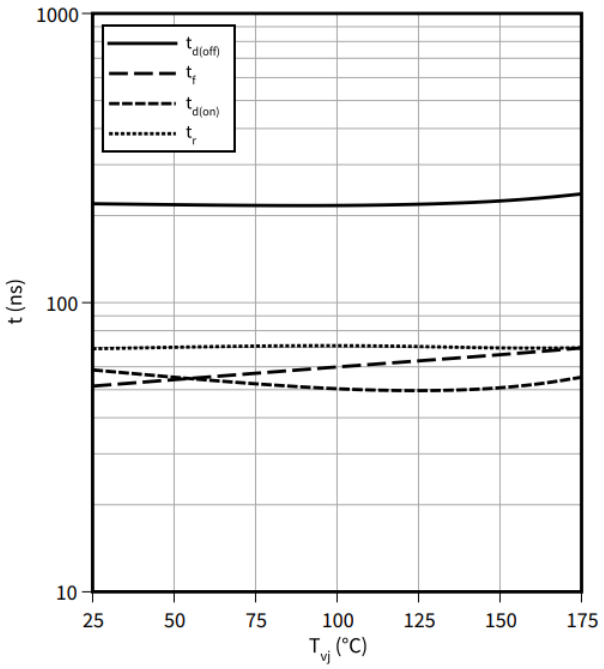
$I_C = 120.0\ A, V_{CE} = 470\ V, T_{vj} = 175\ °C, V_{GE} = -8/15\ V$



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

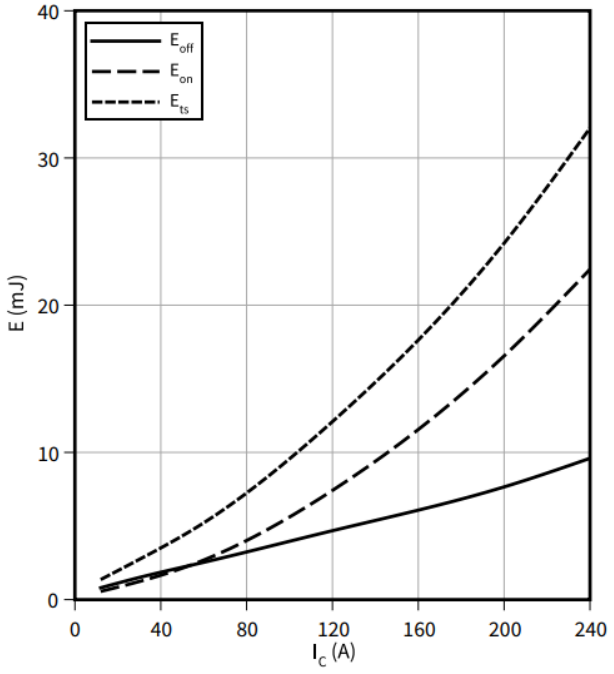
$I_C = 120.0\ A, R_{G(off)} = 5.0\ Ω, V_{CE} = 470\ V, V_{GE} = -8/15\ V, R_{G(on)} = 5\ Ω$



Typical switching energy losses as a function of collector current

$E = f(I_C)$

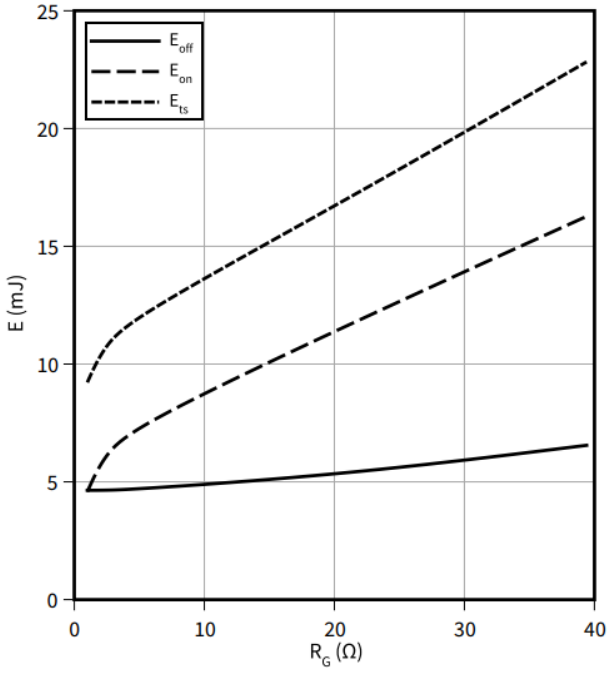
$R_{G(off)} = 5.0\ Ω, V_{CE} = 470\ V, T_{vj} = 175\ °C, V_{GE} = -8/15\ V, R_{G(on)} = 5\ Ω$



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

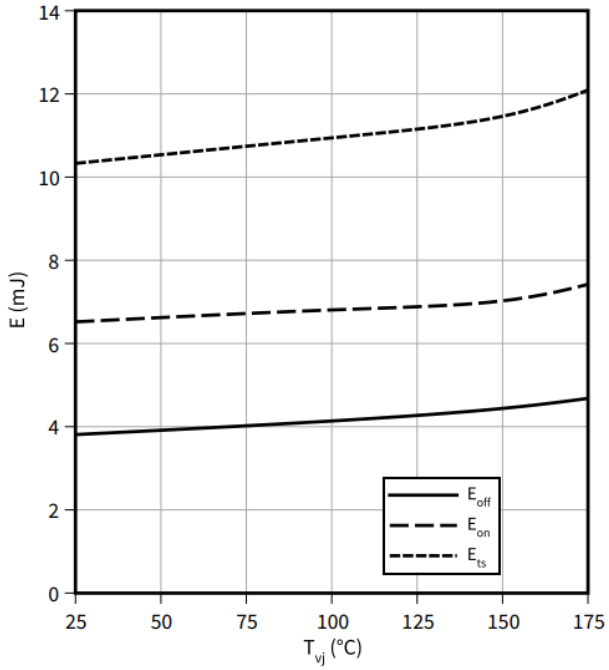
$I_C = 120.0\ A, V_{CE} = 470\ V, T_{vj} = 175\ °C, V_{GE} = -8/15\ V$



Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

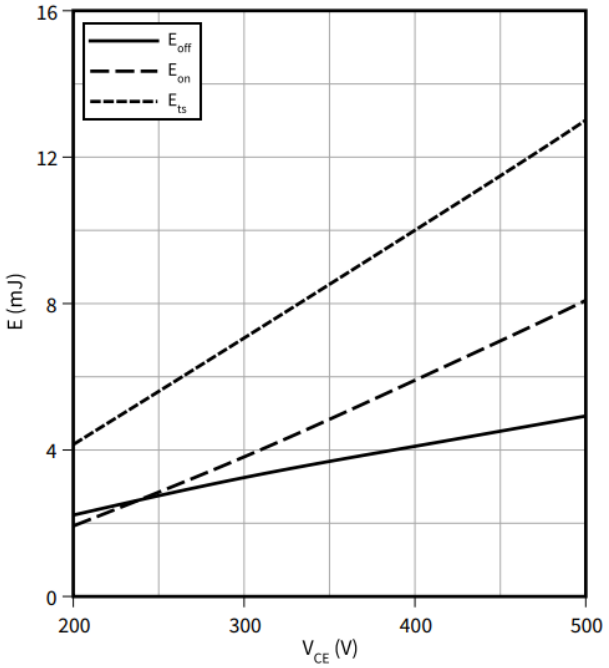
$I_C = 120.0$ A, $R_{G(off)} = 5.0\ \Omega$, $V_{CE} = 470$ V, $V_{GE} = -8/15$ V, $R_{G(on)} = 5\ \Omega$



Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$

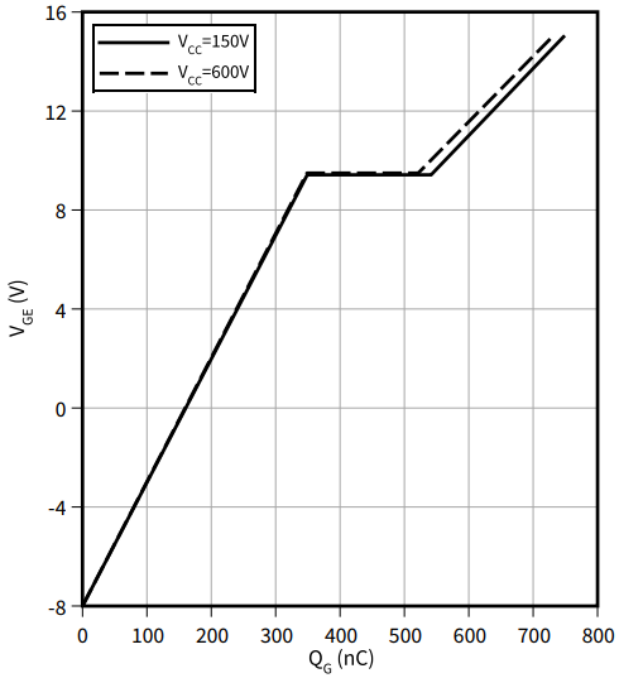
$I_C = 120$ A, $R_{G(off)} = 5\ \Omega$, $T_{vj} \leq 175$ °C, $V_{GE} = -8/15$ V, $R_{G(on)} = 5\ \Omega$



Typical gate charge

$V_{GE} = f(Q_G)$

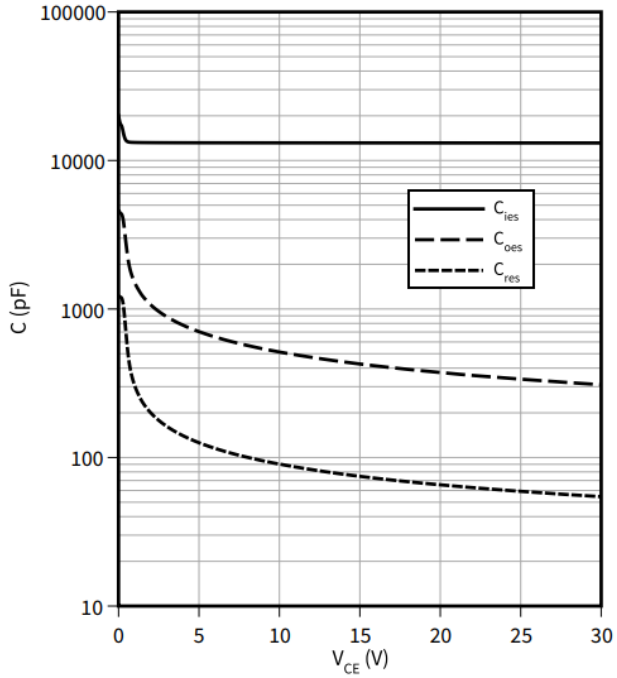
$I_C = 120.0$ A



Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE})$

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

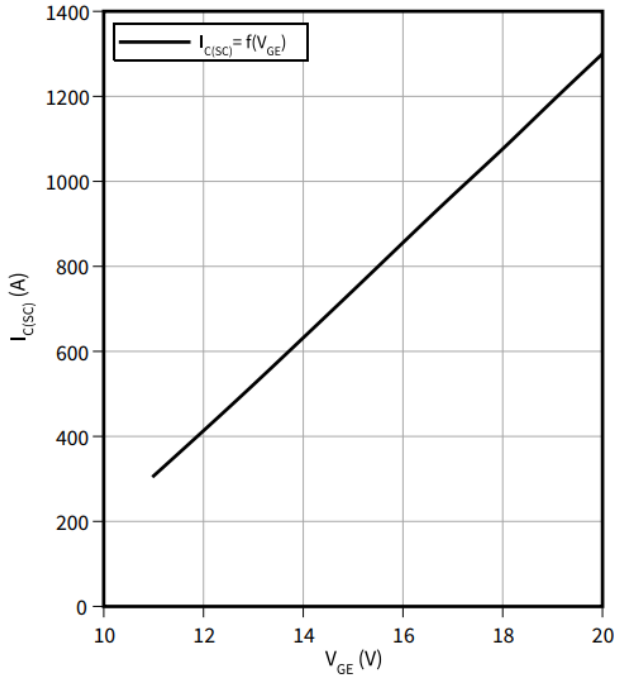


4 特性图

Typical short circuit collector current as a function of gate-emitter voltage

$I_{C(SC)} = f(V_{GE})$

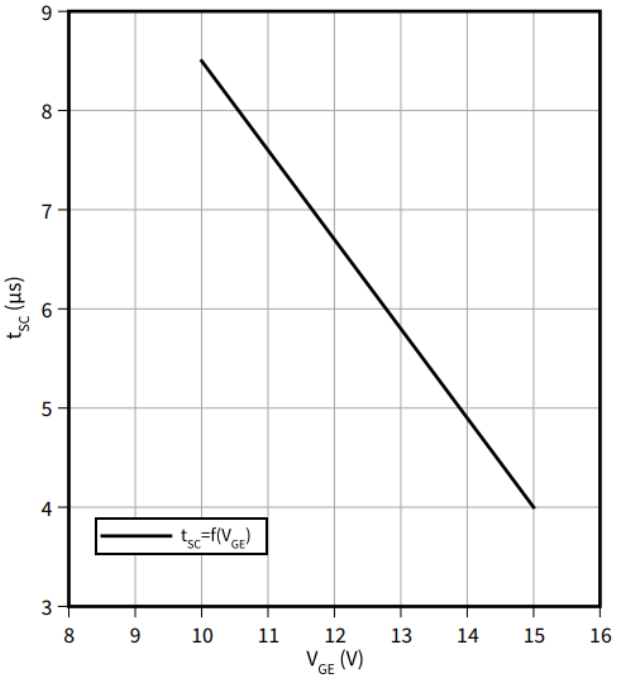
$T_{vj} \leq 175\ °C$, $V_{CC} \leq 470\ V$



Typical Short circuit withstand time as a function of gate-emitter voltage

$t_{SC} = f(V_{GE})$

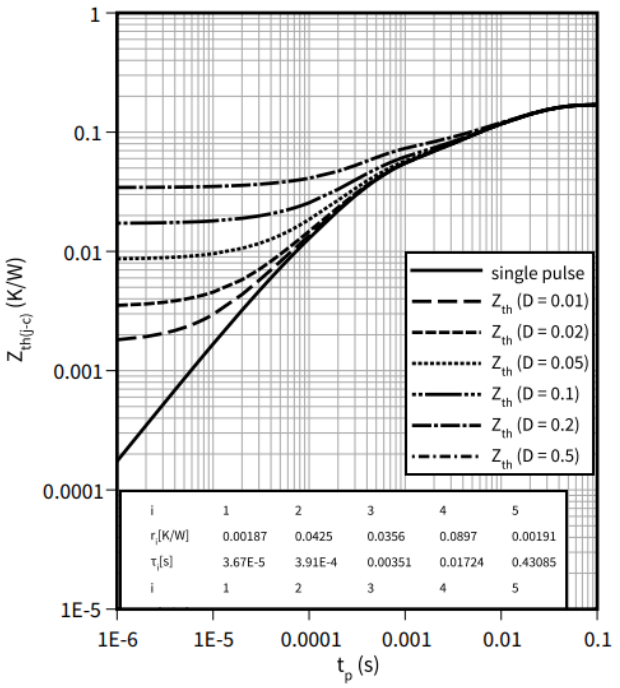
$T_{vj} \leq 175\ °C$, $V_{CC} \leq 470\ V$



IGBT typical transient thermal impedance as a function of pulse width

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

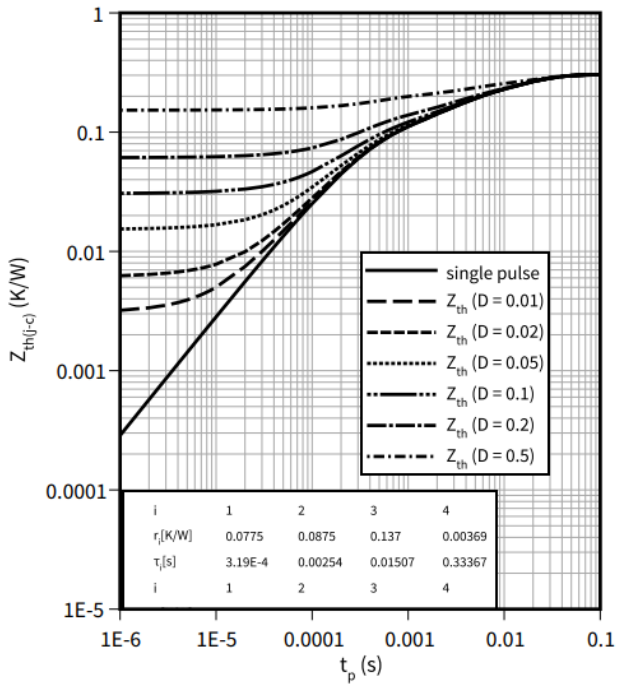
$D = t_p/T$



Diode typical transient thermal impedance as a function of pulse width

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

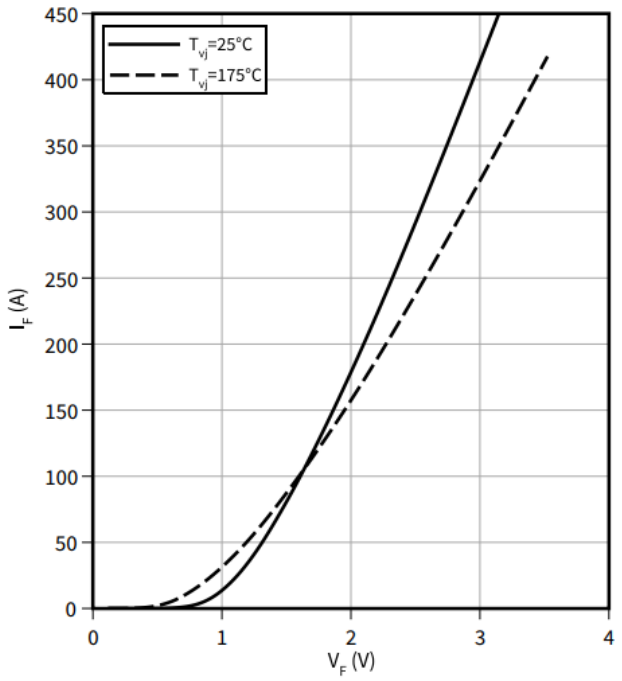
$D = t_p/T$



4 特性图

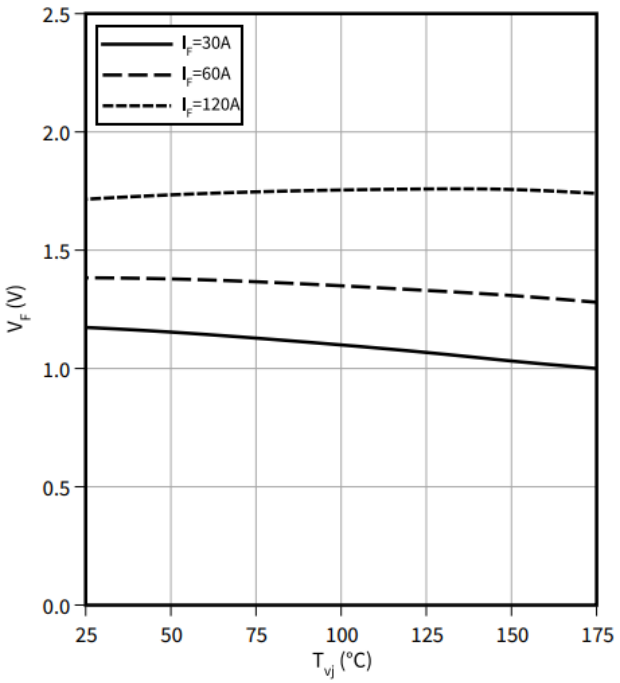
Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



Typical diode forward voltage as a function of junction temperature

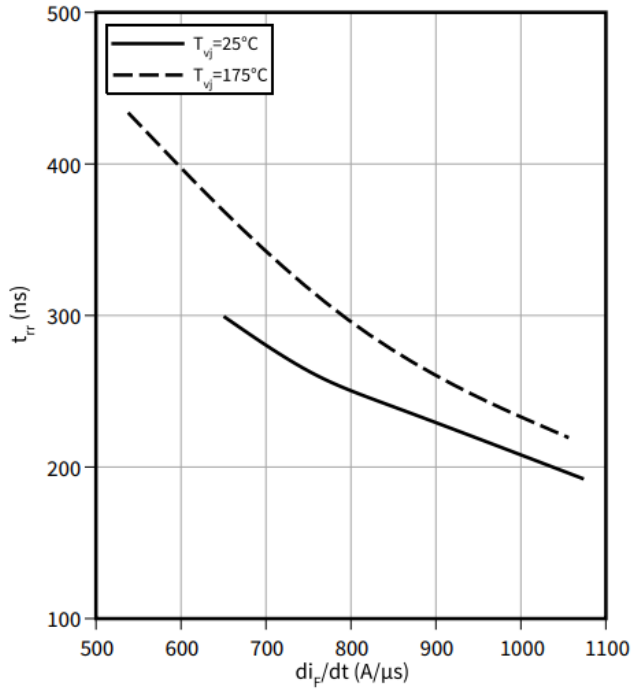
$V_F = f(T_{vj})$



Typical reverse recovery time as a function of diode current slope

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

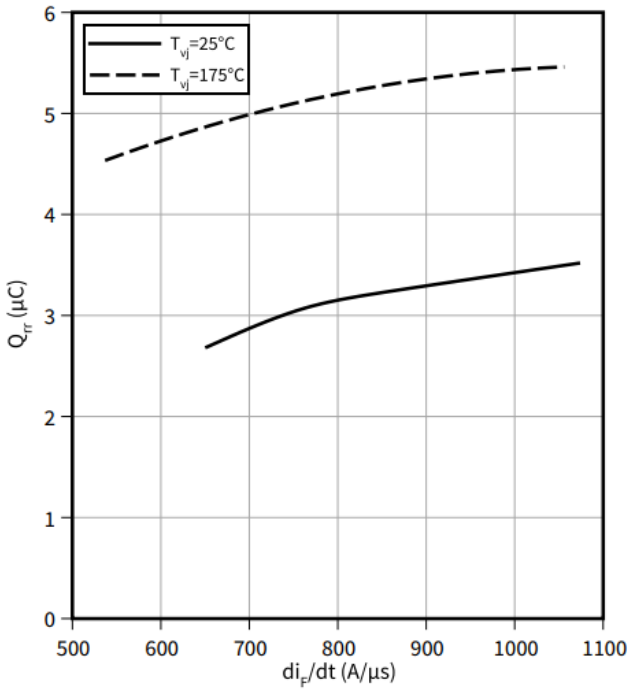
$V_R = 470$ V, $I_F = 120.0$ A



Typical reverse recovery charge as a function of diode current slope

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

$V_R = 470$ V, $I_F = 120.0$ A

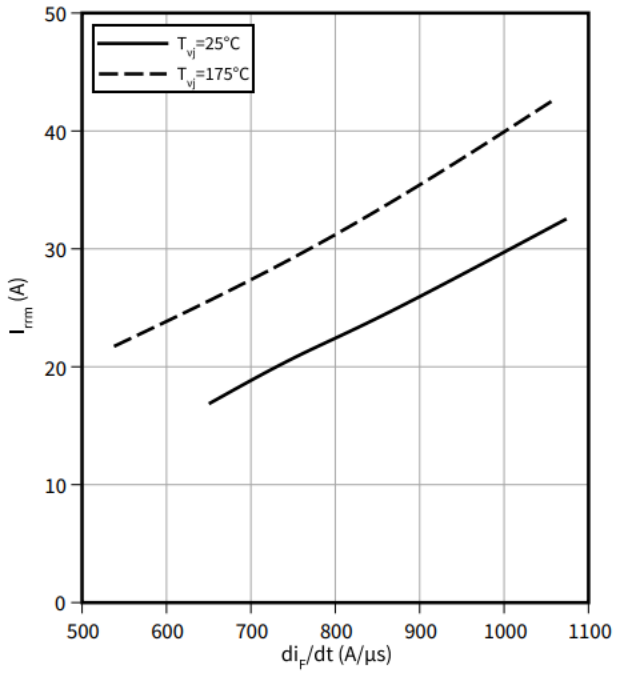


4 特性图

Typical reverse recovery current as a function of diode current slope

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

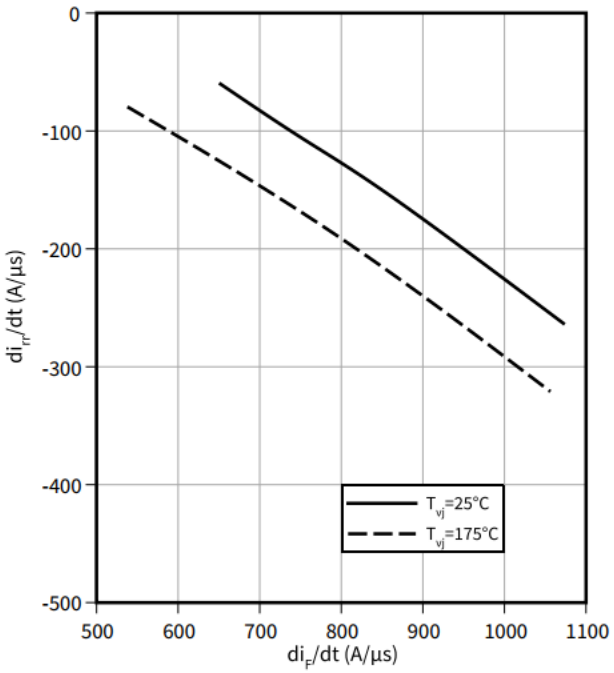
$V_R = 470\ V$, $I_F = 120.0\ A$



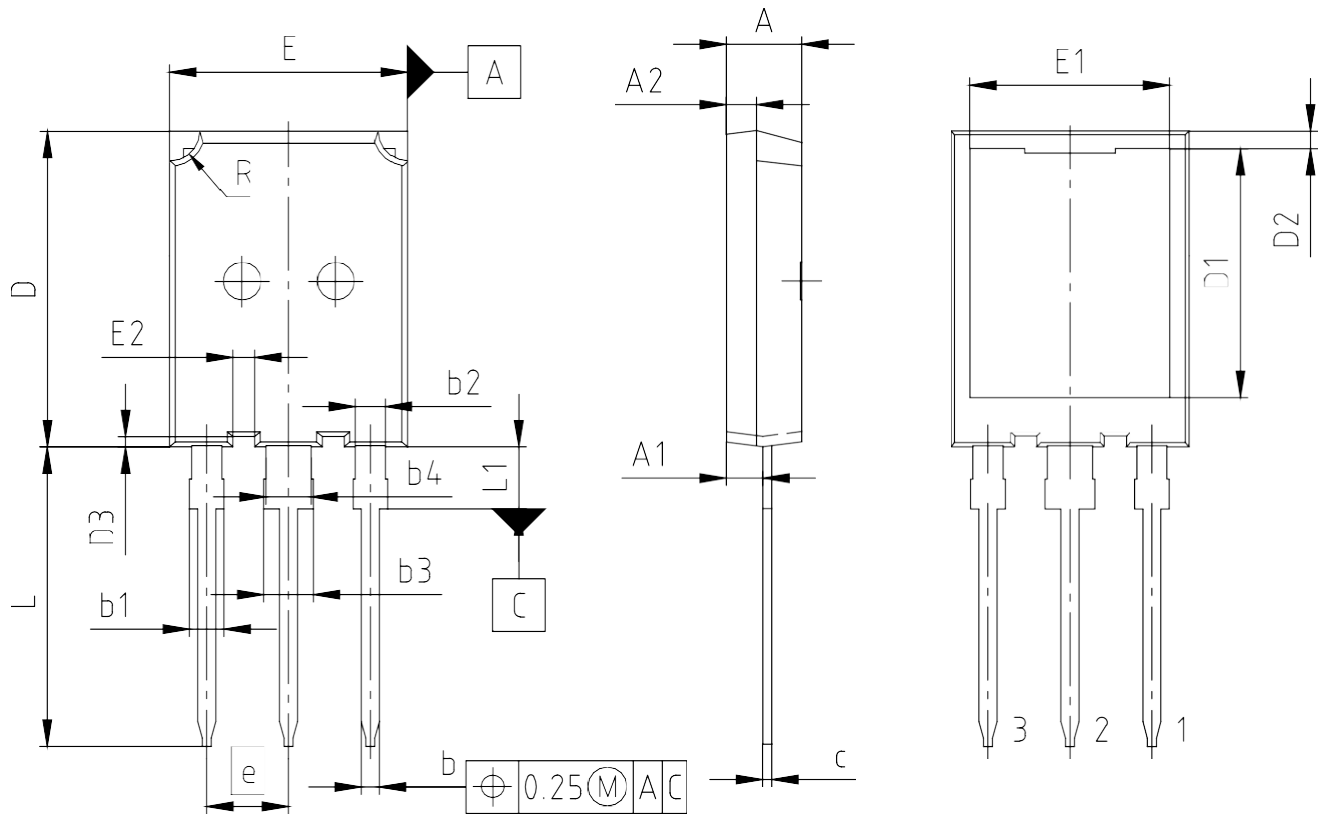
Typical diode peak rate of fall of reverse recovery current as a function of diode current slope

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

$V_R = 470\ V$, $I_F = 120.0\ A$



5 封装外形



PACKAGE - GROUP NUMBER:	PG-TO247-3-U01	
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	---	2.25
b2	1.96	2.06
b3	---	3.25
b4	2.96	3.06
c	0.59	0.66
D	20.90	21.10
D1	16.25	16.85
D2	1.05	1.35
D3	0.58	0.78
E	15.70	15.90
E1	13.10	13.50
E2	1.35	1.55
e	5.44 (BSC)	
N	3	
L	19.80	20.10
L1	3.90	4.30
R	1.90	2.10

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

图 1

修订记录

Document revision	Date of release	Description of changes
1.00	2022-02-16	Final datasheet
1.10	2022-04-07	Updated VF and Rthjc
1.20	2025-06-11	Package drawing, transient thermal impedance plots, and qualification labels updated according to the latest guidelines
1.30	2025-07-03	Qualification labels updated according to the latest guidelines

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