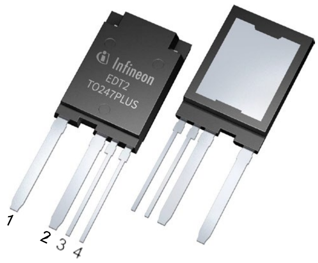
最终数据手册

英飞凌 耐短路 750 V EDT2 IGBT，采用可回流焊接的封装，与 软、 快速恢复二极管共同封装

特性

- V_{CE} = 750 V
- I_C = 160 A
- 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}(C-KE) = 1.22 V（typ.），I_{Cnom}= 160 A，25°C
- 由于回流焊能力，系统 R_{th}可降低至 40%，增加功率输出
- 由于开尔文发射极，与 3 引脚器件相比，开通损耗减少 30%
- 短路耐受时间 t_{sc} = 3 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
- 优异的并联均流能力
- 平滑的开关特性
- 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)
- 低EMI特征
- TO247PLUS 封装，高爬电距离 6.6 mm，400 ≤ CTI< 600
- 高可靠性和使用寿命，经过验证的秒级功率循环。鲁棒性
- 适用于高电流母线的宽电源引脚 (2 mm)
- 用于直接母线连接的阻性焊接引脚
- 无铅镀层的引脚和背板



Halogen-free

RoHS

AEC Qualified

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

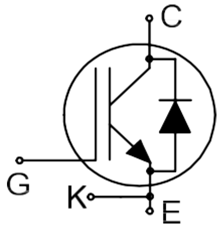
产品验证

- 符合AEC-Q101标准，适用于汽车应用
- 符合JEDEC J-STD-020 MSL2 标准的回流焊 260°C

描述

封装引脚定义：

- 引脚 C (1) & 背面 - 集电极
- 引脚 E (2) - 发射极
- 引脚 K (3) - 开尔文发射极
- 引脚 G (4) - 栅极



Type	Package	Marking
AIKYX160N75CP2	PG-TO247-4-U06	AKYX16FCP

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）。

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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	L_E	simulated starting from L2 at 1 MHz		3.7		nH
Collector-emitter loop inductance	L_{CE}	simulated starting from L2 at 1 MHz		6.2		nH
Main emitter pin resistance	R_E	Simulated starting from L2 at 10 kHz		0.37		mΩ
Storage temperature	T_{stg}		-55		150	°C
Soldering temperature	T_{sold}	reflow soldering (MSL2 according to JEDEC J-STD-020)			260	°C
Thermal resistance, junction-ambient	$R_{th(j-a)}$			40		K/W
IGBT thermal resistance, junction-case	$R_{th(j-c)}$			0.15	0.2[1)]	K/W
Diode thermal resistance, junction-case	$R_{th(j-c)}$			0.28	0.36[1)]	K/W

1) 通过仿真定义，不进行生产测试

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		750	V
DC collector current, limited by T_{vjmax}	I_C		$T_c = 25$ °C	200	A
			$T_c = 100$ °C	160	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}			480	A
Turn-off safe operating area		$V_{CE} \leq 750$ V, $T_{vj} \leq 175$ °C		480	A
Gate-emitter voltage	V_{GE}			±20	V
Transient gate-emitter voltage	V_{GE}	$t_p = 10$ µs, $D < 0.01$		±30	V
Short-circuit withstand time[1)]	t_{SC}	$V_{CC} \leq 470$ V, $V_{GE} = -8/15$ V, Allowed number of short circuits < 1000, Time between short circuits ≥ 1.0 s, $T_{vj} = 25$ °C		3	µs
Power dissipation	P_{tot}	$T_{vj} = 175$ °C	$T_c = 25$ °C	750	W
			$T_c = 100$ °C	375	

1) 用开尔文发射极测量驱动

表3 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	V_{CEsat}	$I_C = 160$ A, $V_{GE} = 15$ V	$T_{vj} = 25$ °C	1.2	1.37	1.55	V
			$T_{vj} = 175$ °C		1.6		
Collector-Kelvin emitter saturation voltage	V_{CEsat} *(C-KE)*	$I_C = 160$ A, $V_{GE} = 15$ V	$T_{vj} = 25$ °C		1.22		V
Gate-emitter threshold voltage	V_{GEth}	$I_C = 2.15$ 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		8		mA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0$ V, $V_{GE} = 20$ V				100	nA
Transconductance	g_{fs}	$I_C = 160$ A, $V_{CE} = 20$ V			117		S
Short-circuit collector current	I_{SC}	$V_{CC} \leq 470$ V, $V_{GE} = -8/15$ V, $t_{SC} \leq 3$ µs, Allowed number of short circuits < 1000, Time between short circuits ≥ 1.0 s, $T_{vj} = 25$ °C	$T_{vj} = 25$ °C		1500		A
Input capacitance	C_{ies}	$V_{CE} = 25$ V, $V_{GE} = 0$ V, $f = 100$ kHz			17300		pF
Output capacitance	C_{oes}	$V_{CE} = 25$ V, $V_{GE} = 0$ V, $f = 100$ kHz			443		pF
Reverse transfer capacitance	C_{res}	$V_{CE} = 25$ V, $V_{GE} = 0$ V, $f = 100$ kHz			79		pF
Gate charge	Q_G	$V_{CC} = 600$ V, $I_C = 160$ A, $V_{GE} = -8/15$ V			975		nC
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 470$ V, $V_{GE} = -8/15$ V, $R_{G(on)} = 5$ Ω, $L_\sigma = 20$ nH, $C_\sigma = 15$ pF	$T_{vj} = 25$ °C, $I_C = 160$ A		64		ns
			$T_{vj} = 175$ °C, $I_C = 160$ A		64		
Rise time (inductive load)	t_r	$V_{CC} = 470$ V, $V_{GE} = -8/15$ V, $R_{G(on)} = 5$ Ω, $L_\sigma = 20$ nH, $C_\sigma = 15$ pF	$T_{vj} = 25$ °C, $I_C = 160$ A		35		ns
			$T_{vj} = 175$ °C, $I_C = 160$ A		43		
Turn-off delay time	$t_{d(off)}$	$V_{CC} = 470$ V, $V_{GE} = -8/15$ V, $R_{G(on)} = 5$ Ω, $L_\sigma = 20$ nH, $C_\sigma = 15$ pF	$T_{vj} = 25$ °C, $I_C = 160$ A		234		ns
			$T_{vj} = 175$ °C, $I_C = 160$ A		315		
Fall time (inductive load)	t_f	$V_{CC} = 470$ V, $V_{GE} = -8/15$ V, $R_{G(on)} = 5$ Ω, $L_\sigma = 20$ nH, $C_\sigma = 15$ pF	$T_{vj} = 25$ °C, $I_C = 160$ A		57		ns
			$T_{vj} = 175$ °C, $I_C = 160$ A		121		

（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_{CC} = 470 V, V_{GE} = -8/15 V, $R_{G(on)}$ = 5 Ω, L_{σ} = 20 nH, C_{σ} = 15 pF	T_{vj} = 25 °C, I_C = 160 A		5.5		mJ
			T_{vj} = 175 °C, I_C = 160 A		7.7		
Turn-off energy	E_{off}	V_{CC} = 470 V, V_{GE} = -8/15 V, $R_{G(on)}$ = 5 Ω, L_{σ} = 20 nH, C_{σ} = 15 pF	T_{vj} = 25 °C, I_C = 160 A		4.9		mJ
			T_{vj} = 175 °C, I_C = 160 A		8.8		
Total switching energy	E_{ts}	V_{CC} = 470 V, V_{GE} = -8/15 V, $R_{G(on)}$ = 5 Ω, L_{σ} = 20 nH, C_{σ} = 15 pF	T_{vj} = 25 °C, I_C = 160 A		10.4		mJ
			T_{vj} = 175 °C, I_C = 160 A		16.5		
Operating junction temperature	T_{vj}			-40		175	°C

1) 包括反向恢复电流引起的 IGBT 损耗

注： *特征参数，在 T_{vj} = 25°C 下测定，除非另有说明。*

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		750	V
Diode forward current, limited by T_{vjmax}	I_F		T_c = 25 °C	200	A
			T_c = 100 °C	160	
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpulse}			480	A
Power dissipation	P_{tot}	T_{vj} = 175 °C	T_c = 25 °C	417	W
			T_c = 100 °C	208	

表5 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode forward voltage	V_F	I_F = 160 A	T_{vj} = 25 °C	1.6	1.8	2	V
			T_{vj} = 175 °C		1.85		

（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	T_{vj} = 25 °C, I_F = 160 A, $-di_F/dt$ = 3996 A/µs		5.5		µC
			T_{vj} = 175 °C, I_F = 160 A, $-di_F/dt$ = 3425 A/µs		14		
Diode peak reverse recovery current	I_{rrm}	V_R = 470 V	T_{vj} = 25 °C, I_F = 160 A, $-di_F/dt$ = 3996 A/µs		68.7		A
			T_{vj} = 175 °C, I_F = 160 A, $-di_F/dt$ = 3425 A/µs		108.1		
Reverse recovery energy	E_{rec}	V_R = 470 V, L_σ = 20 nH, C_σ = 15 pF	T_{vj} = 25 °C, I_F = 160 A, $-di_F/dt$ = 3996 A/µs		2.1		mJ
			T_{vj} = 175 °C, I_F = 160 A, $-di_F/dt$ = 3425 A/µs		4.9		
Operating junction temperature	T_{vj}			-40		175	°C

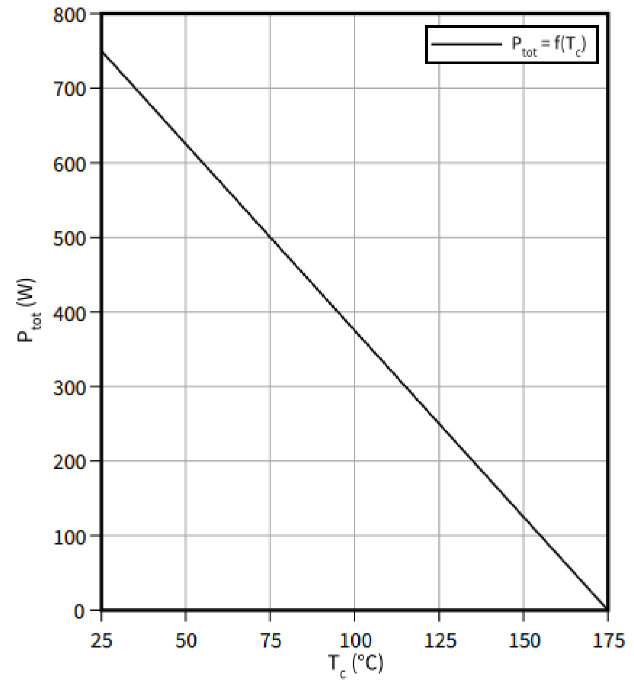
注： *为了获得最佳的使用寿命和可靠性，英飞凌建议工作条件不超过本数据手册中所述最大额定值的80%。*

4 特性图

Power dissipation as a function of case temperature

$P_{tot} = f(T_c)$

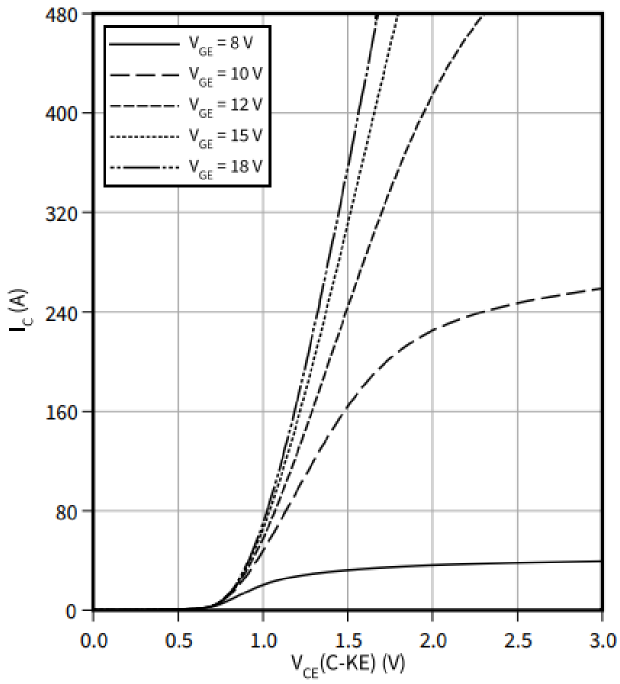
$T_{vj} \leq 175$ °C



Typical output characteristic

$I_C = f(V_{CE}(C\text{-}KE))$

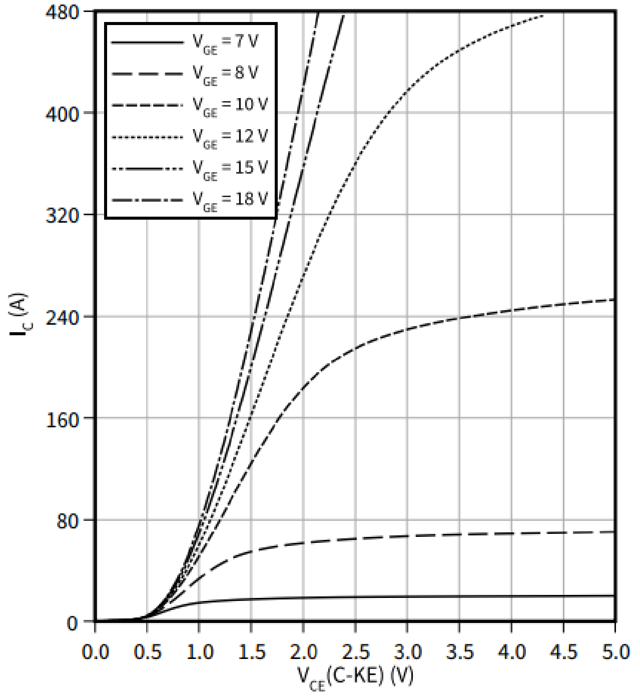
$T_{vj} = 25$ °C



Typical output characteristic

$I_C = f(V_{CE}(C\text{-}KE))$

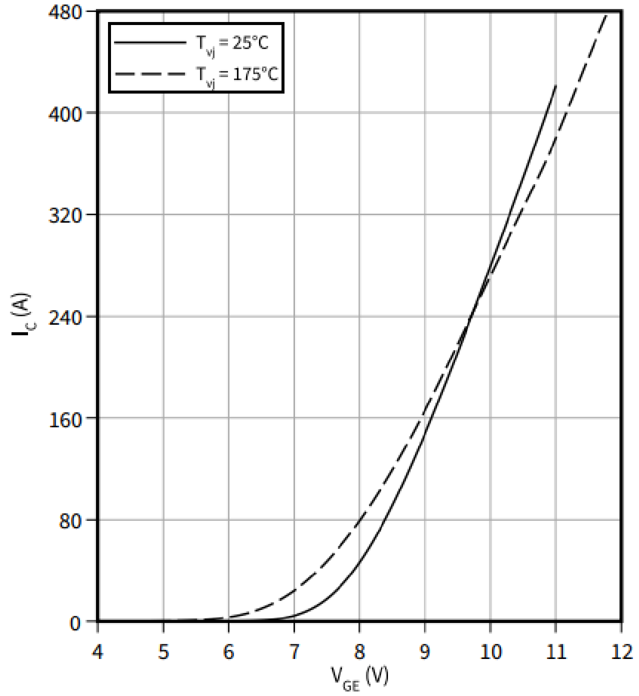
$T_{vj} = 175$ °C



Typical transfer characteristic

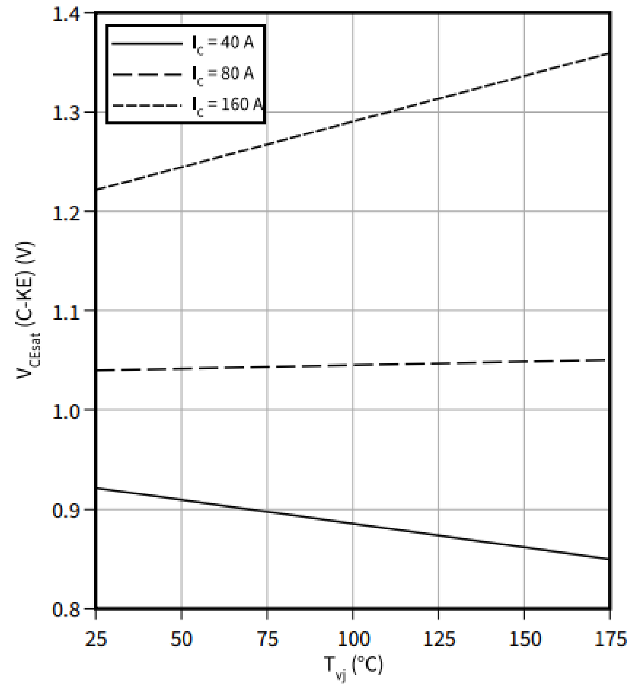
$I_C = f(V_{GE})$

$V_{CE} = 20$ V



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

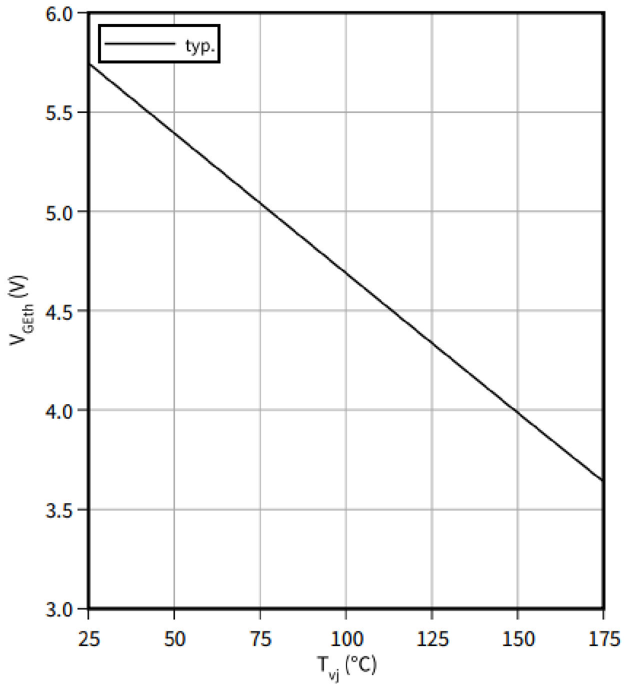
V_{CEsat} (C-KE) = f(T_{vj})



Gate-emitter threshold voltage as a function of junction temperature

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

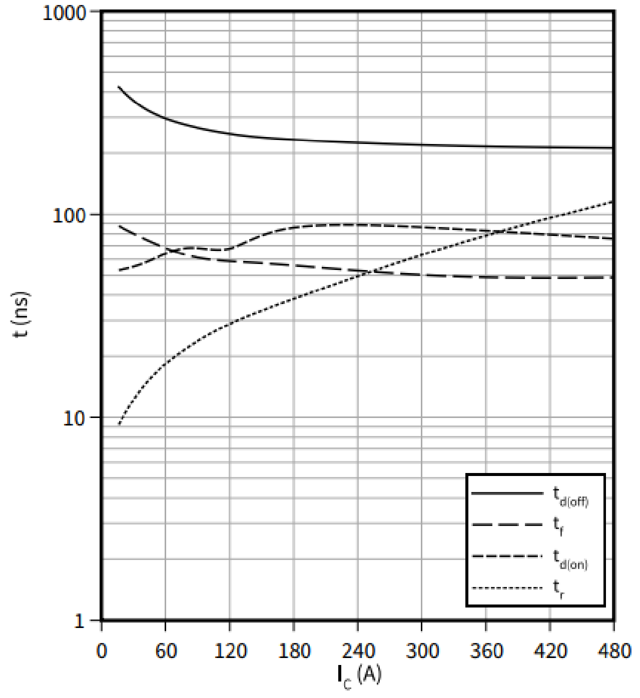
I_C = 2.15 mA



Typical switching times as a function of collector current

t = f(I_C)

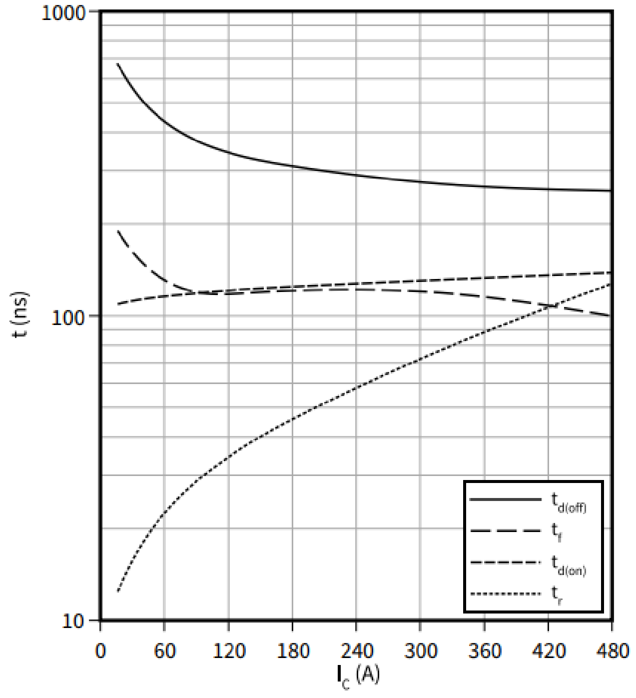
V_{CC} = 470 V, T_{vj} = 25 °C, R_G = 5 Ω



Typical switching times as a function of collector current

t = f(I_C)

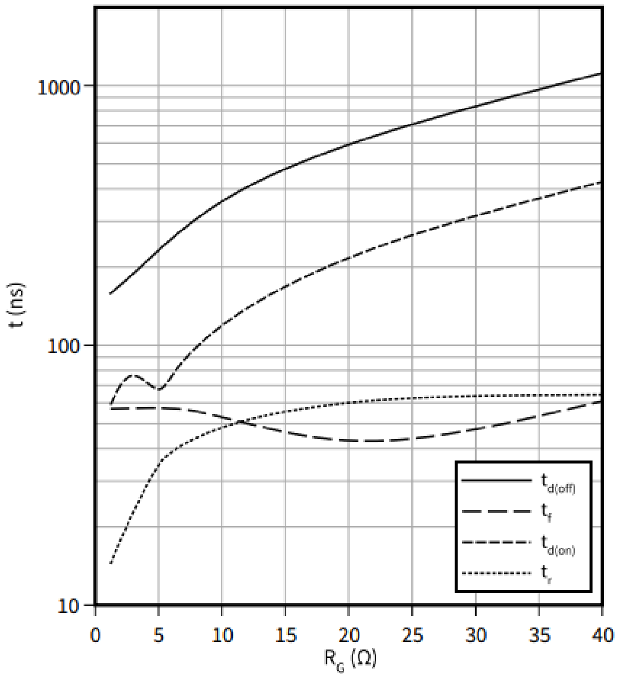
V_{CC} = 470 V, T_{vj} = 175 °C, R_G = 5 Ω



Typical switching times as a function of gate resistor

$t = f(R_G)$

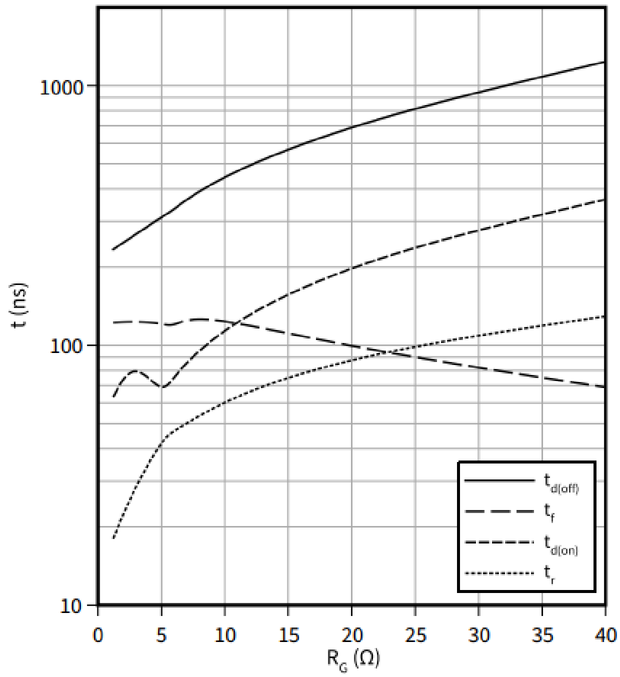
$I_C = 160$ A, $V_{CC} = 470$ V, $T_{vj} = 25$ °C



Typical switching times as a function of gate resistor

$t = f(R_G)$

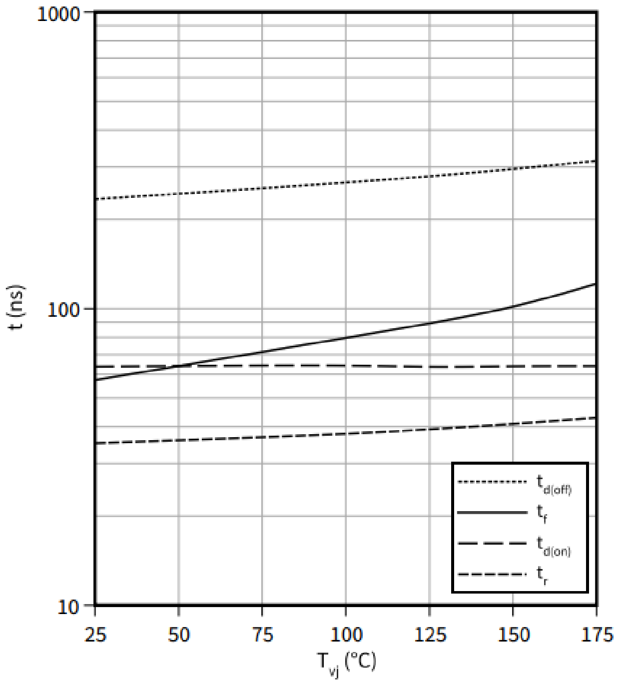
$I_C = 160$ A, $V_{CC} = 470$ V, $T_{vj} = 175$ °C



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

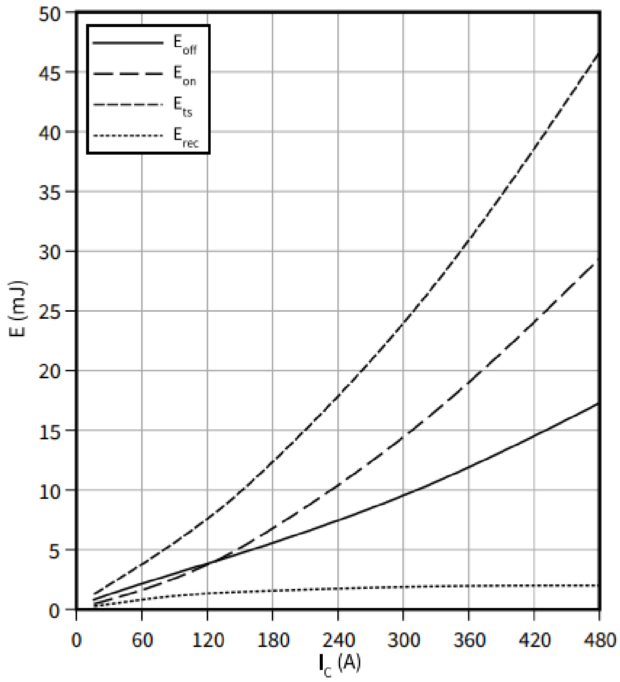
$I_C = 160$ A, $V_{CC} = 470$ V, $R_G = 5$ Ω



Typical switching energy losses as a function of collector current

$E = f(I_C)$

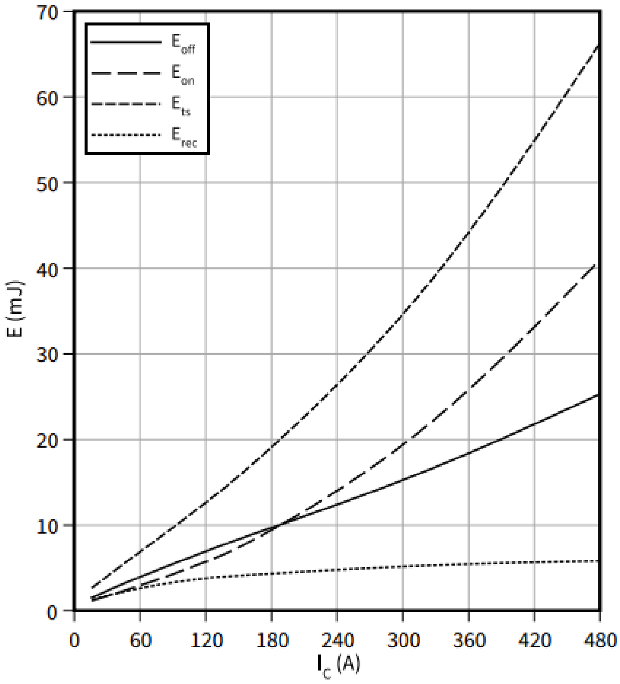
$V_{CC} = 470$ V, $T_{vj} = 25$ °C, $R_G = 5$ Ω



Typical switching energy losses as a function of collector current

$E = f(I_C)$

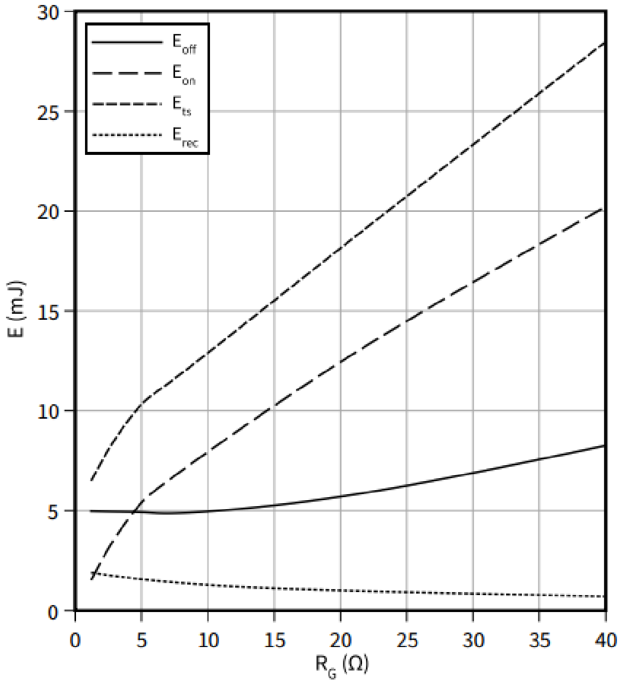
$V_{CC} = 470$ V, $T_{vj} \geq 25$ °C, $R_G = 5$ Ω



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

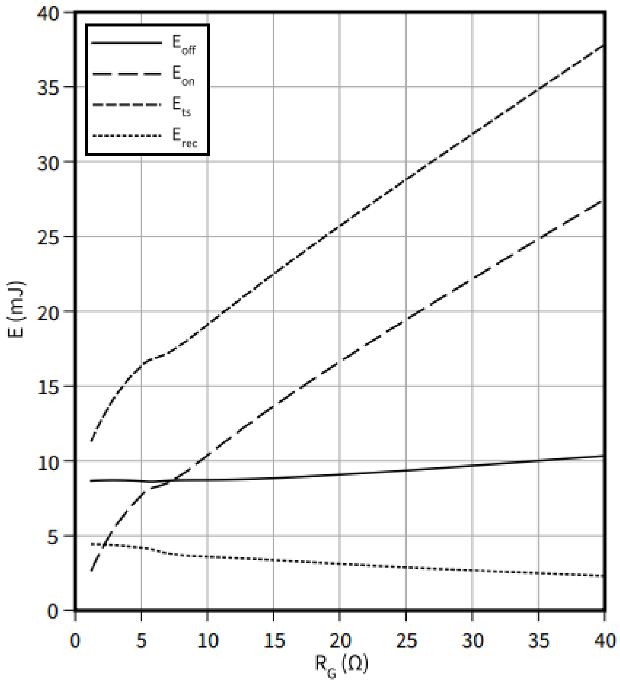
$I_C = 160$ A, $V_{CC} = 470$ V, $T_{vj} = 25$ °C



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

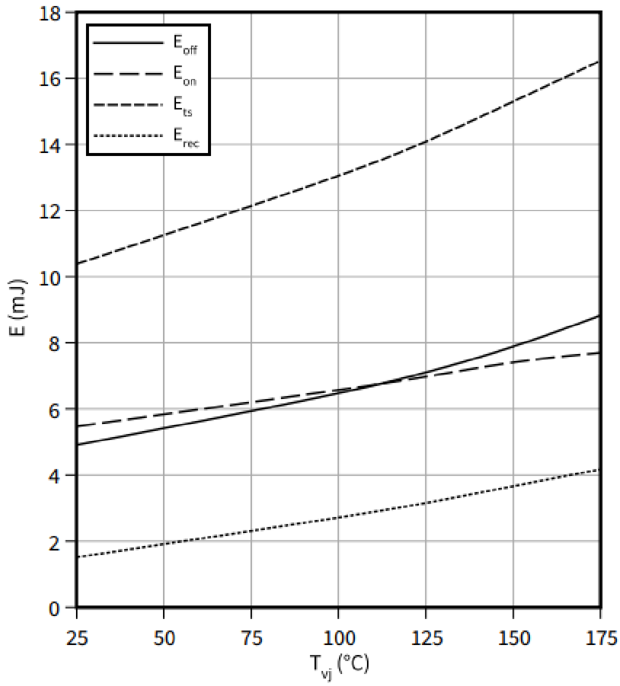
$I_C = 160$ A, $V_{CC} = 470$ V, $T_{vj} = 175$ °C



Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

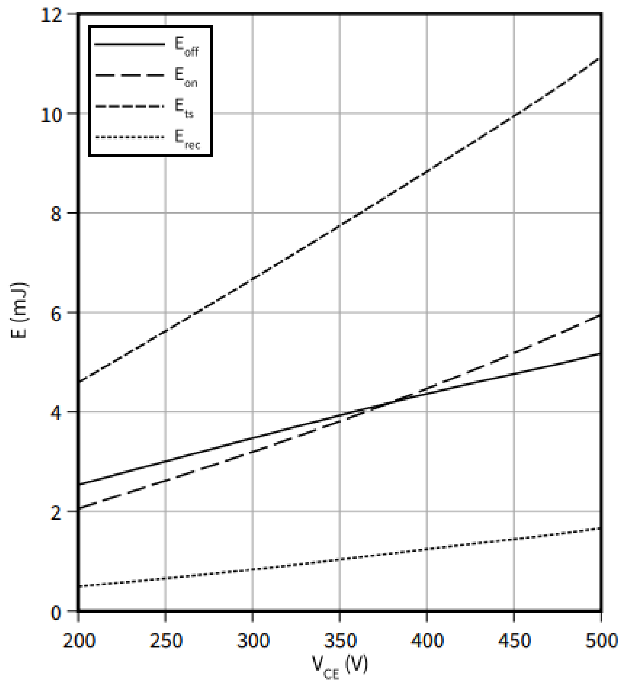
$I_C = 160$ A, $V_{CC} = 470$ V, $R_G = 5$ Ω



Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$

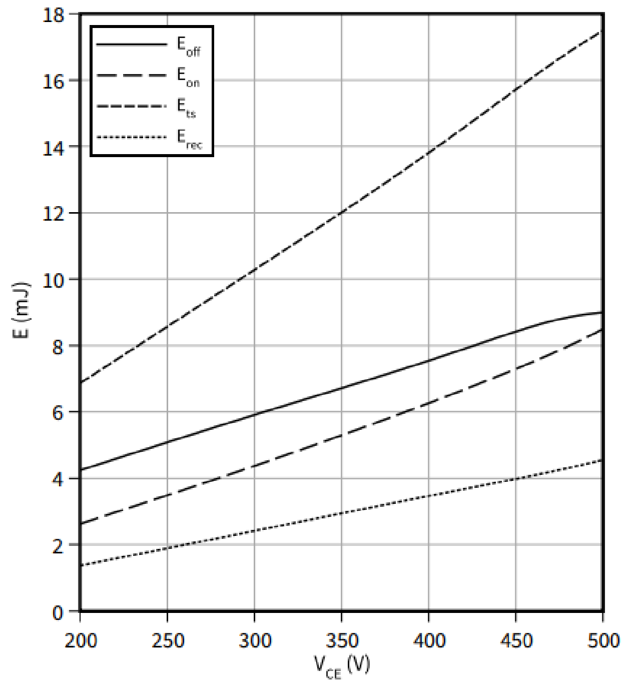
$I_C = 160$ A, $T_{vj} = 25$ °C, $R_G = 5$ Ω



Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$

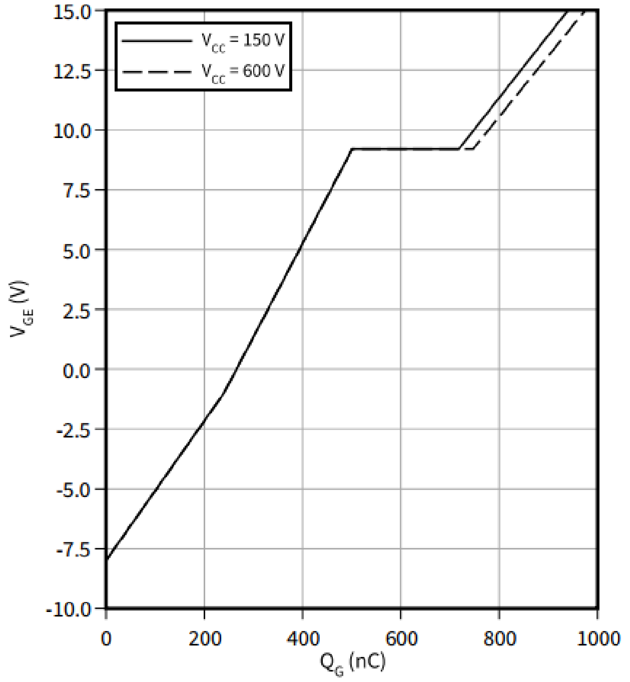
$I_C = 160$ A, $T_{vj} = 175$ °C, $R_G = 5$ Ω



Typical gate charge

$V_{GE} = f(Q_G)$

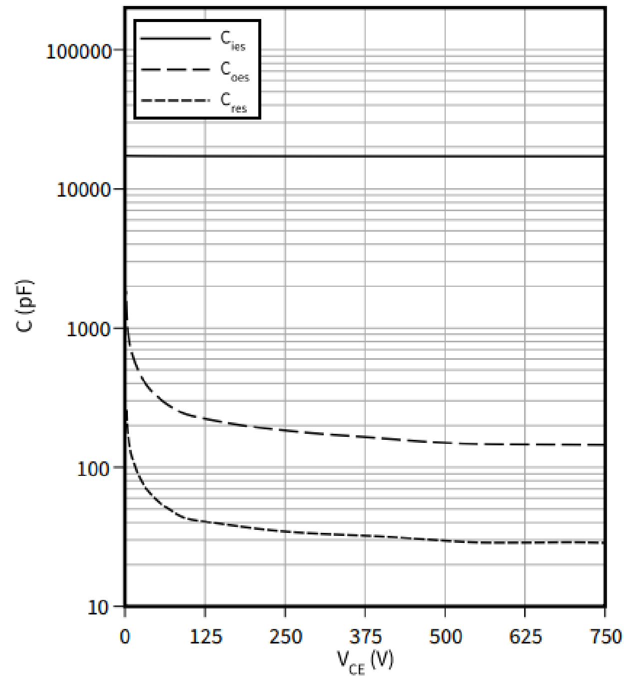
$I_C = 160$ A



Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE})$

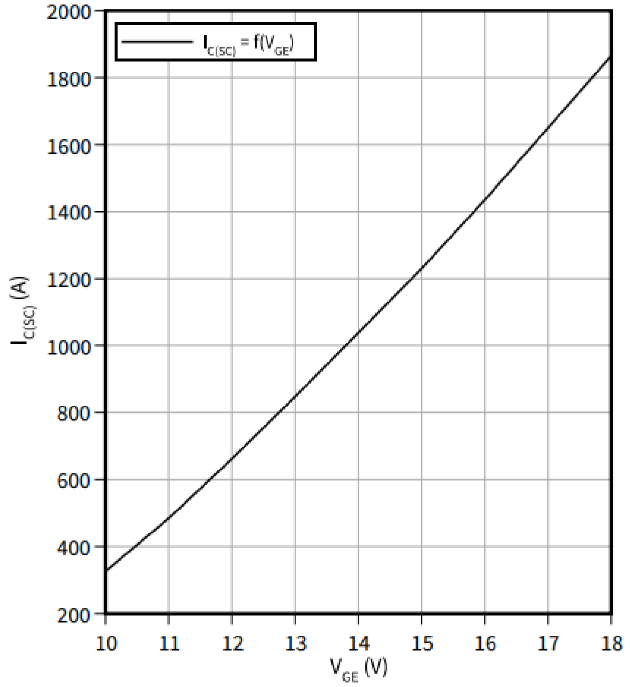
f = 100 kHz



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

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

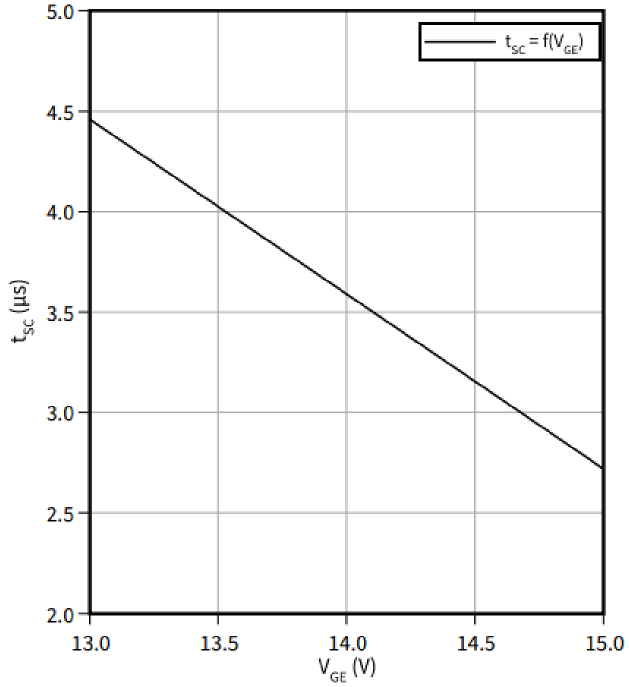
$T_{vj} = 175\ °C$, $V_{CC} = 470\ V$



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

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

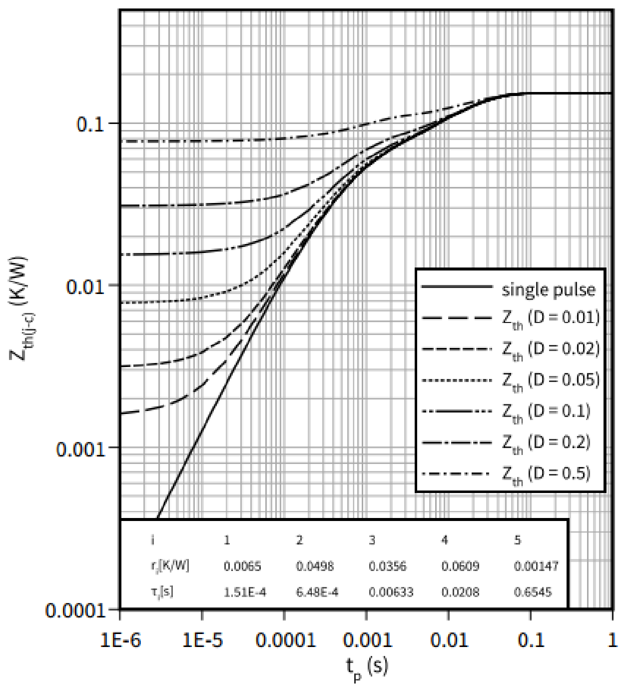
$T_{vj} = 175\ °C$, $V_{CC} = 470\ V$



IGBT typical transient thermal impedance as a function of pulse width

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

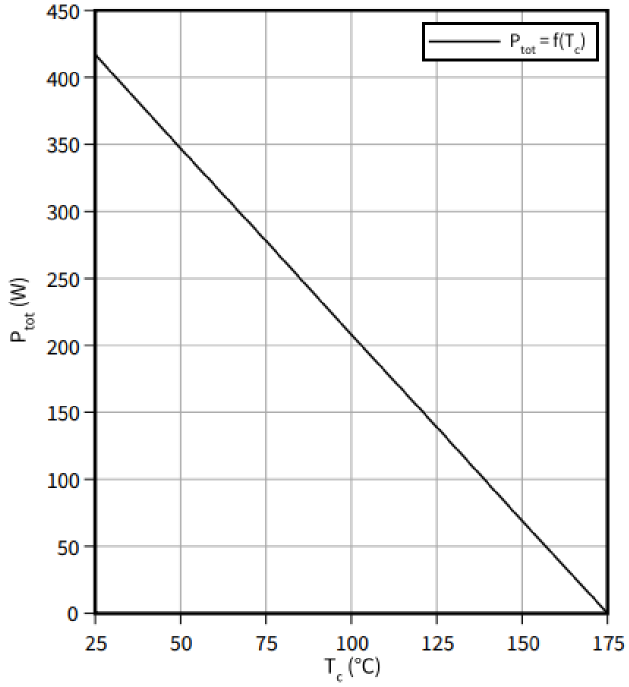
$D = t_p/T$



Power dissipation as a function of case temperature

$P_{tot} = f(T_c)$

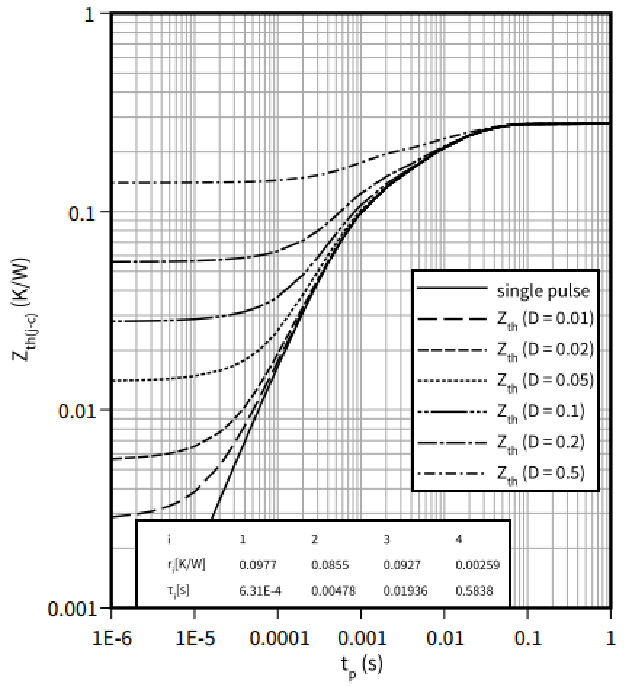
$T_{vj} \leq 175\ °C$



Diode typical transient thermal impedance as a function of pulse width

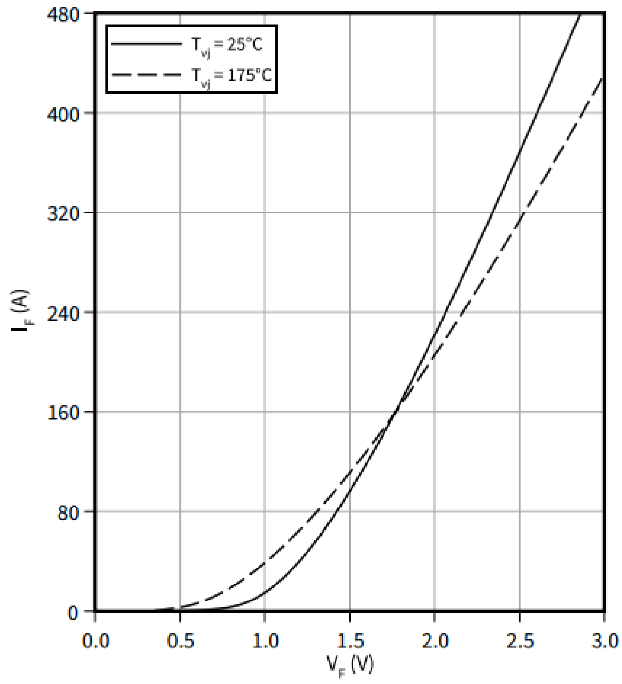
$Z_{th(j-c)} = f(t_p)$

$D = t_p/T$



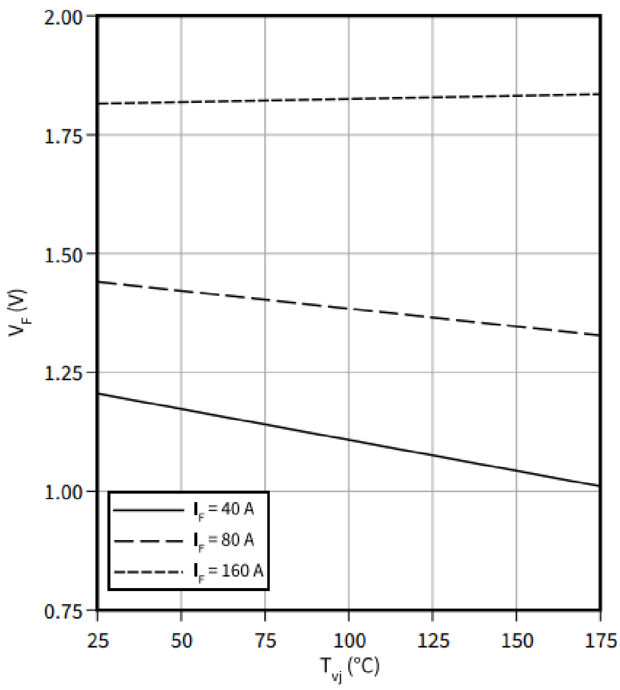
Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



Typical diode forward voltage as a function of junction temperature

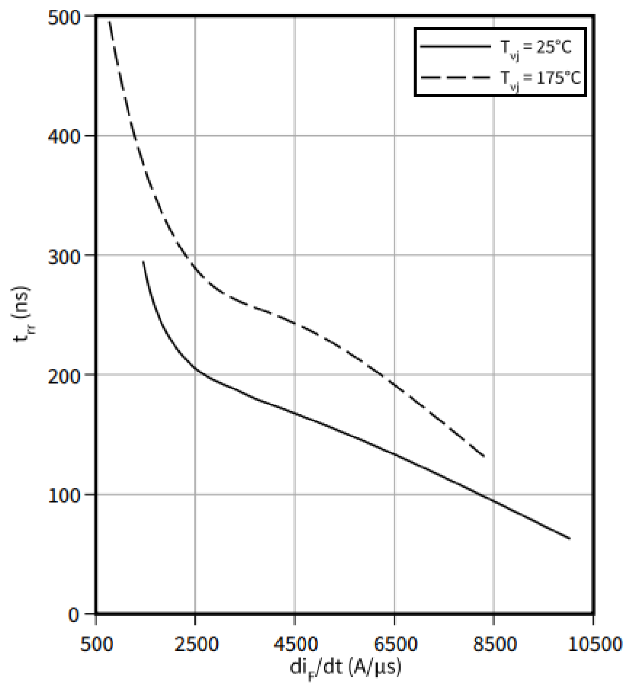
$V_F = f(T_{vj})$



Typical reverse recovery time as a function of diode current slope

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

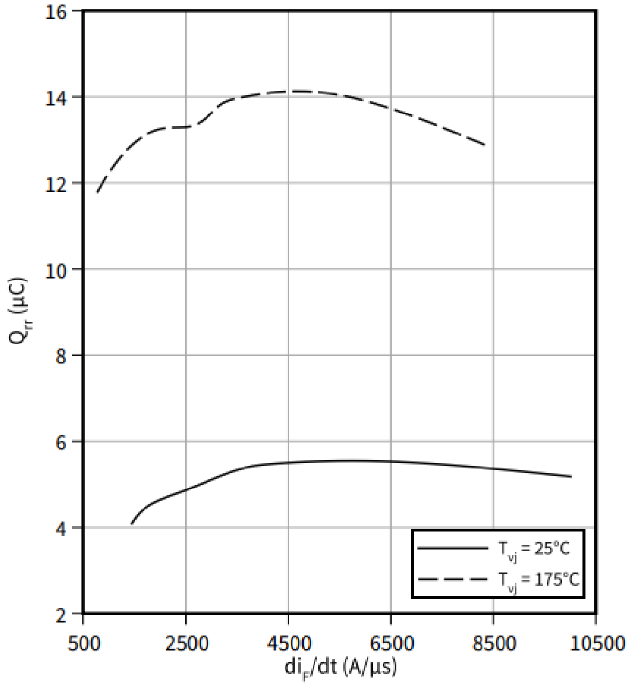
$V_R = 470$ V, $I_F = 160$ A



Typical reverse recovery charge as a function of diode current slope

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

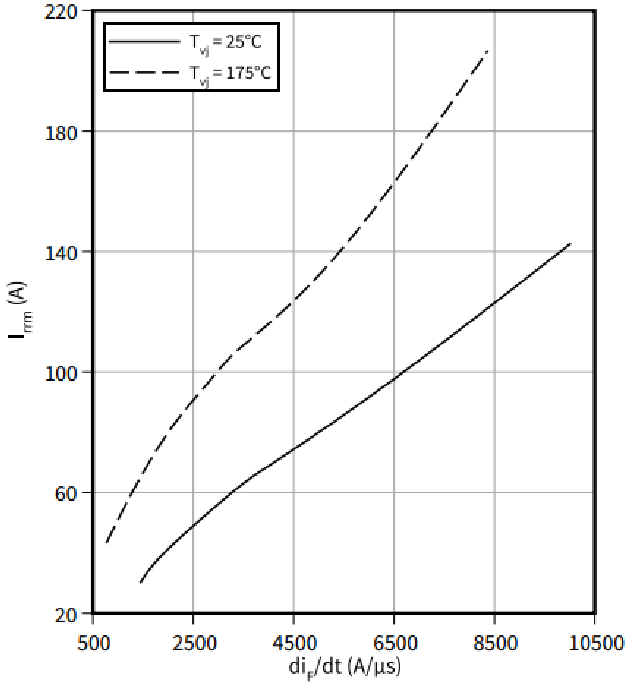
$V_R = 470\ V, I_F = 160\ A$



Typical reverse recovery current as a function of diode current slope

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

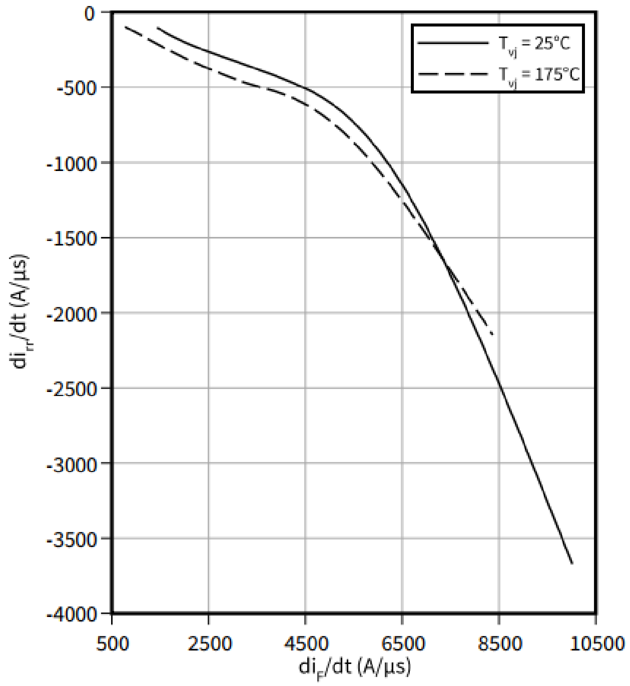
$V_R = 470\ V, I_F = 160\ A$



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

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

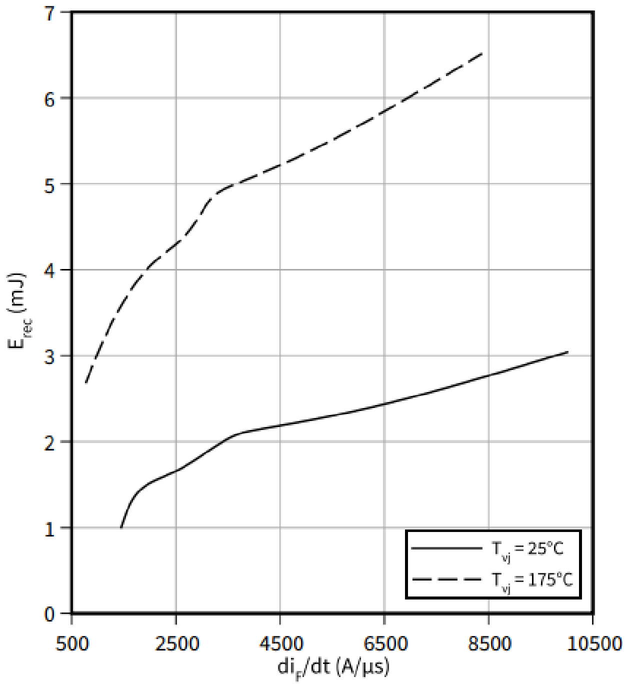
$V_R = 470\ V, I_F = 160\ A$

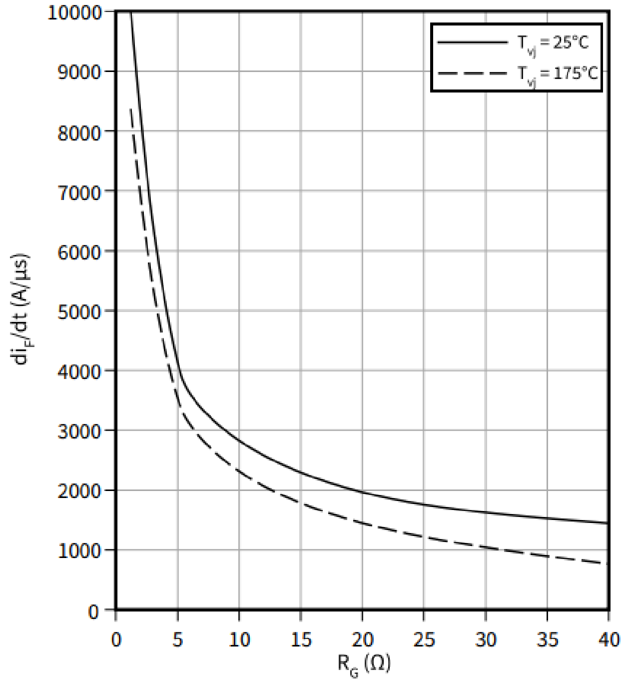


Typical reverse energy losses as a function of diode current slope

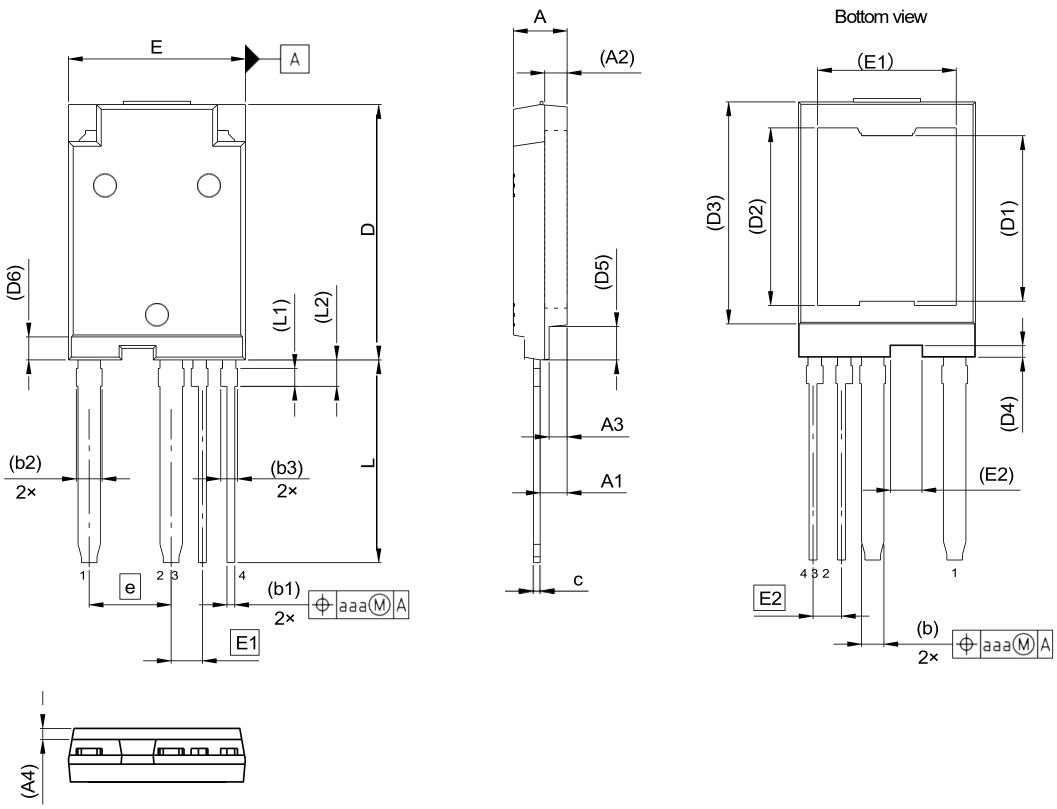
$E_{rec} = f(di_F/dt)$

$V_R = 470\ V, I_F = 160\ A$



Typical diode current slope as a function of gate resistor $di_F/dt = f(R_G)$ $V_R = 470$ V, $I_F = 160$ A	
	

5 封装外形



PACKAGE - GROUP NUMBER: **PG-TO247-4-U06**

DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	4.7	4.9
A1	2.16	2.66
A2	2	
A3	1.51	1.71
A4	0.99	
b	2	
b1	0.7	
b2	2.3	
b3	1.5	
c	0.5	0.7
D	22.7	22.9
D1	14.79	
D2	15.86	
D3	19.82	

DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
D4	1.03	
D5	2.98	
D6	2.05	
E	15.7	15.9
E1	12.38	
E2	2.8	
e	7.32	
e1	2.79	
e2	2.54	
L	18.01	18.21
L1	1.6	
L2	2.36	
aaa	0.25	

1) All metal surfaces tin plated except area of cut
2) Mold gate protrusion after degating.
All dimensions are in units mm
The drawing is in compliance with ISO 128-30, Projection Method 3 [⊕◁]
Drawing according to ISO 8015, general tolerances

图 1

6 测试条件

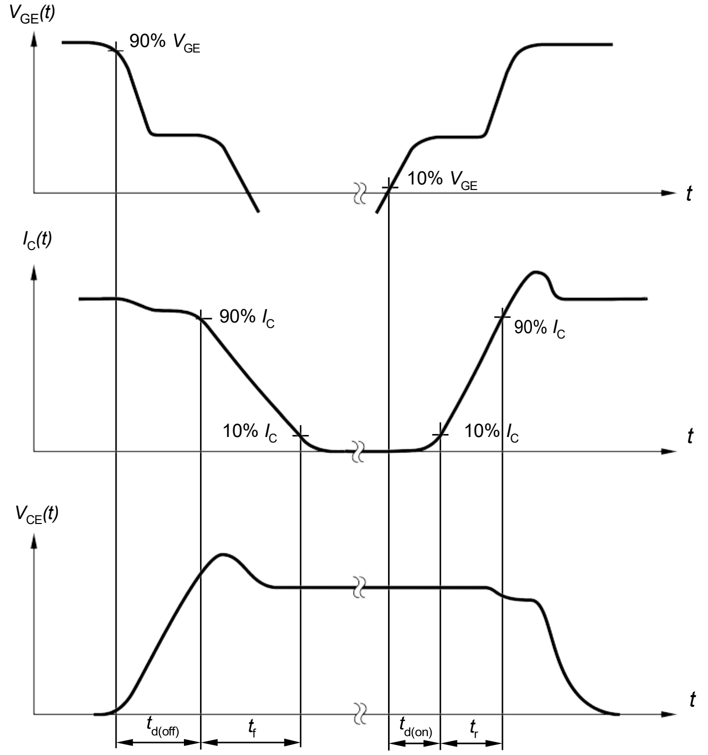


图 A Definition of switching times

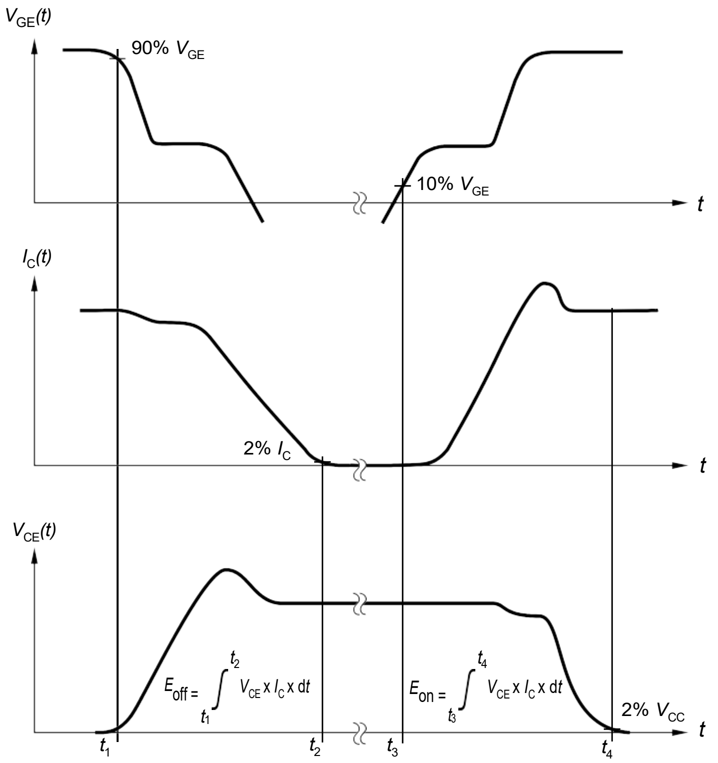


Figure B. Definition of switching losses

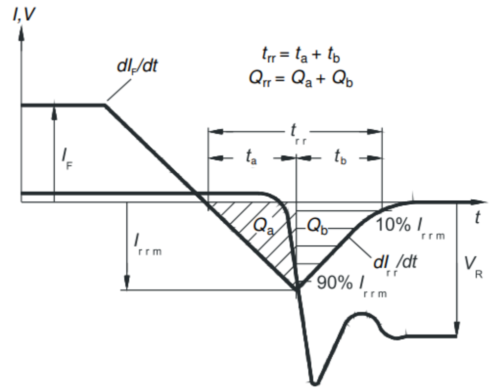


Figure C. **Definition of diode switching characteristics**

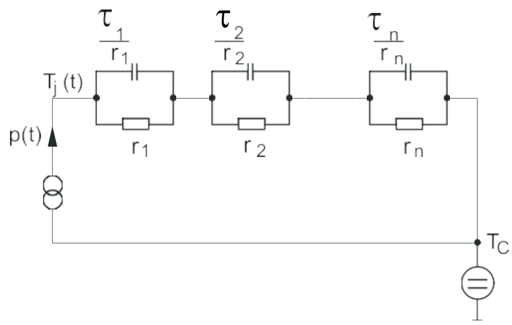


Figure D. Thermal equivalent circuit

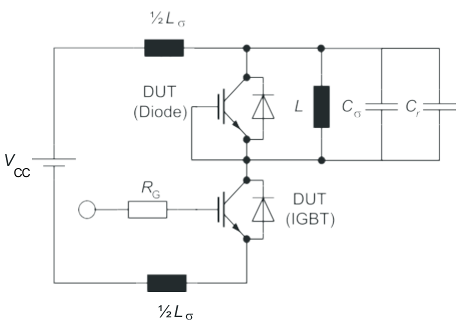


Figure E. **Dynamic test circuit**
Parasitic inductance L_{α},
parasitic capacitor C_{α},
relief capacitor C_r,
(only for ZVT switching)

图 2

修订记录

Document revision	**Date of release**	**Description of changes**
0.10	2024-03-26	Preliminary datasheet
1.00	2024-07-24	Final datasheet
1.10	2024-07-29	Change Output Characteristics graph for 175°C with correct data
1.20	2025-06-11	Transient thermal impedance plots, package naming convention, and qualification labels updated according to the latest guidelines

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因此，我们同时提供该中文译文版本的最新英文原文供您阅读，请参见 http://www.infineon.com
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