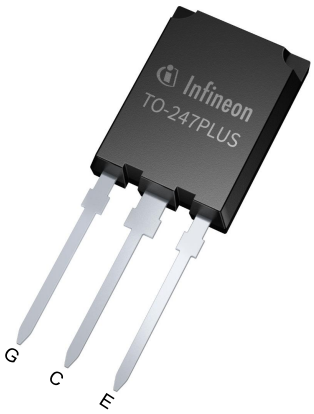
Final datasheet
Short circuit rugged 750 V EDT2 IGBT co-packed with fast soft recovery diode

Features

- V_{CE} = 750 V
- I_C = 200 A
- Best-in-class highest power density, I_C = 200 A
- 750 V collector-emitter blocking voltage capability
- Suitable for 470 V V_{DC} systems and increase overvoltage margin for 400 V V_{DC} systems
- Very low V_{CEsat} = 1.3 V (typ.) at I_{Cnom} = 200 A, 25°C
- Short circuit robust t_{sc} = 5 µs at V_{CE} = 470 V, V_{GE} = 15 V
- Self limiting current under short circuit condition
- Positive thermal coefficient and very tight parameter distribution for easy paralleling
- A Reduced number of parallel devices is required due to I_{nom} = 200 A
- Excellent current sharing in parallel operation
- Smooth switching characteristics, low EMI signature
- Low gate charge Q_G
- Simple gate drive design
- Co-packed with fast soft recovery emitter controlled 3 diode
- TO247PLUS package with high creepage distance
- High reliability



AEC Qualified

Halogen-free

RoHS

Lead-free

Green

Potential applications

- xEV Inverter
- DC-link discharge switch
- Automotive aux-drives

Product validation

- Qualified for automotive applications
- Qualified according to AEC-Q101

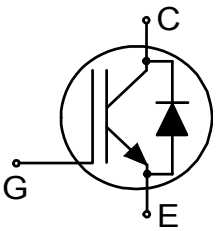
Description

Package pin definition:

• Pin C & backside - collector

• Pin E - emitter

• Pin G - gate



Type	Package	Marking
AIKQ200N75CP2	PG-TO247-3-U01	AKQ20FCP

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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
Thermal resistance, junction-ambient	$R_{th(j-a)}$				40	K/W
IGBT thermal resistance, junction-case	$R_{th(j-c)}$			0.1	0.14	K/W
Diode thermal resistance, junction-case	$R_{th(j-c)}$			0.2	0.26	K/W

2 IGBT

Table 2 Maximum rated values

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	200	A
			T_c = 100 °C	200	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}			600	A
Turn-off safe operating area		$V_{CE} \le 750$ V, t_p = 1 µs, $T_{vj} \le 175$ °C		600	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}	$V_{CC} \le 470$ 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	1071	W
			T_c = 100 °C	535	

Table 3 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	V_{CEsat}	I_C = 200 A, V_{GE}=15 V	T_{vj} = 25 °C	1.2	1.3	1.5	V
			T_{vj} = 175 °C		1.6		
Gate-emitter threshold voltage	V_{GEth}	I_C = 2.6 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		6000		
Gate-emitter leakage current	I_{GES}	V_{CE}=0 V, V_{GE}=20 V				100	nA
Transconductance	g_{fs}	I_C = 200 A, V_{CE}=20 V			140		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		1250		A
Input capacitance	C_{ies}	V_{CE}=25 V, V_{GE}=0 V, f=100 kHz			21300		pF
Output capacitance	C_{oes}	V_{CE}=25 V, V_{GE}=0 V, f=100 kHz			535		pF
Reverse transfer capacitance	C_{res}	V_{CE}=25 V, V_{GE}=0 V, f=100 kHz			93		pF
Gate charge	Q_G	V_{CC} = 600 V, I_C = 200 A			1260		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 = 200 A		89		ns
			T_{vj} = 175 °C, I_C = 200 A		85		
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 = 200 A		120		ns
			T_{vj} = 175 °C, I_C = 200 A		117		
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 = 200 A		266		ns
			T_{vj} = 175 °C, I_C = 200 A		284		
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 = 200 A		46		ns
			T_{vj} = 175 °C, I_C = 200 A		60		

(table continues...)

Table 3 (continued) Characteristic values

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 = 200 A		15.3		mJ
			T_{vj} = 175 °C, I_C = 200 A		16.3		
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 = 200 A		7		mJ
			T_{vj} = 175 °C, I_C = 200 A		8.1		
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 = 200 A		22.3		mJ
			T_{vj} = 175 °C, I_C = 200 A		24.4		
Operating junction temperature	T_{vj}			-40		175	°C

1) Includes reverse recovery losses

3 Diode

Table 4 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Diode forward current, limited by T_{vjmax}	I_F		T_c = 25 °C	200	A
			T_c = 100 °C	200	
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpulse}			600	A
Power dissipation	P_{tot}		T_c = 25 °C	576	W
			T_c = 100 °C	288	

Table 5 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode forward voltage	V_F	I_F = 200 A	T_{vj}=25 °C		1.8	1.95	V
			T_{vj}=175 °C		1.9		

(table continues...)

Table 5 (continued) Characteristic values

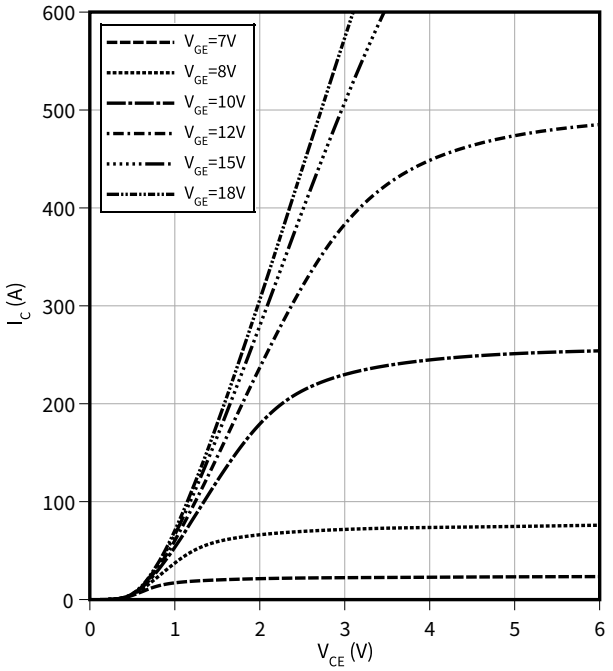
Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode reverse recovery charge	Q_{rr}	V_R < 470 V, $R_{G(on)}$ = 4.8 Ω	T_{vj} = 25 °C, I_F = 200 A, $-di_F/dt$ = 1060 A/µs		4.7		µC
			T_{vj} = 175 °C, I_F = 200 A, $-di_F/dt$ = 1110 A/µs		7.5		
Diode peak reverse recovery current	I_{rrm}	V_R < 470 V, $R_{G(on)}$ = 4.8 Ω	T_{vj} = 25 °C, I_F = 200 A, $-di_F/dt$ = 1060 A/µs		41		A
			T_{vj} = 175 °C, I_F = 200 A, $-di_F/dt$ = 1110 A/µs		56		
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, $-di_F/dt$ = 1060 A/µs		1.32		mJ
			T_{vj}=175 °C, $-di_F/dt$ = 1110 A/µs		2.16		
Operating junction temperature	T_{vj}			-40		175	°C

4 Characteristics diagrams

Typical output characteristic

$I_C = f(V_{CE})$

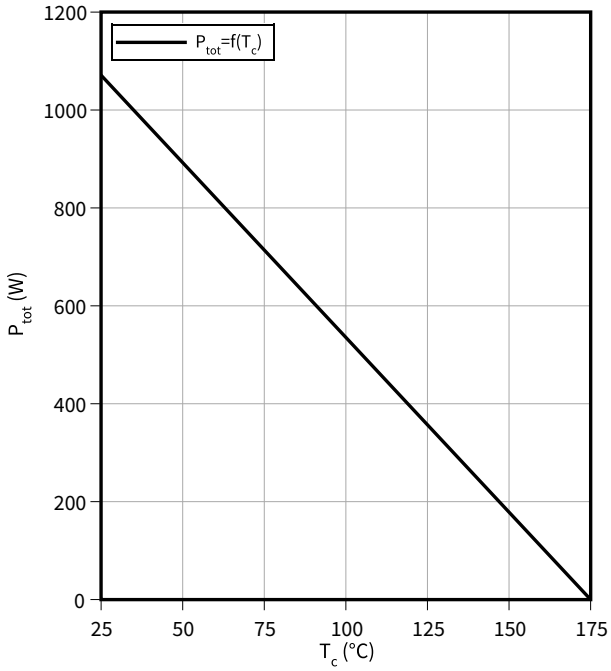
$T_{vj} = =175\ °C$



Power dissipation as a function of case temperature

$P_{tot} = f(T_c)$

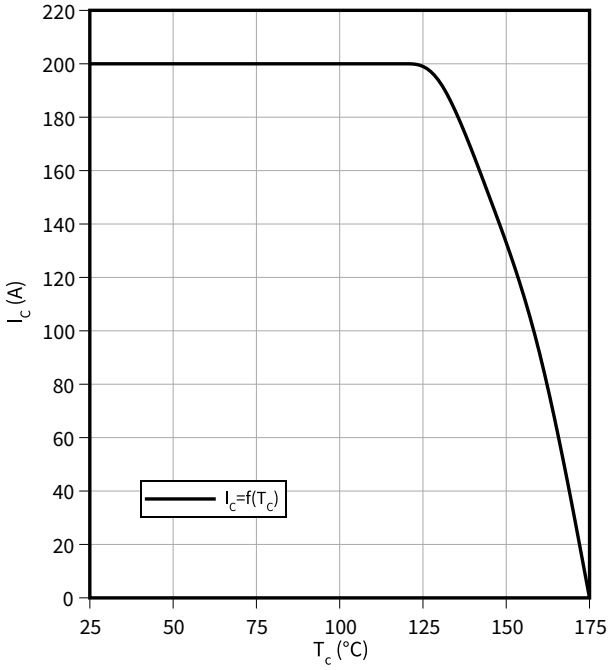
$T_{vj} \leq 175\ °C$



Collector current as a function of case temperature

$I_C = f(T_c)$

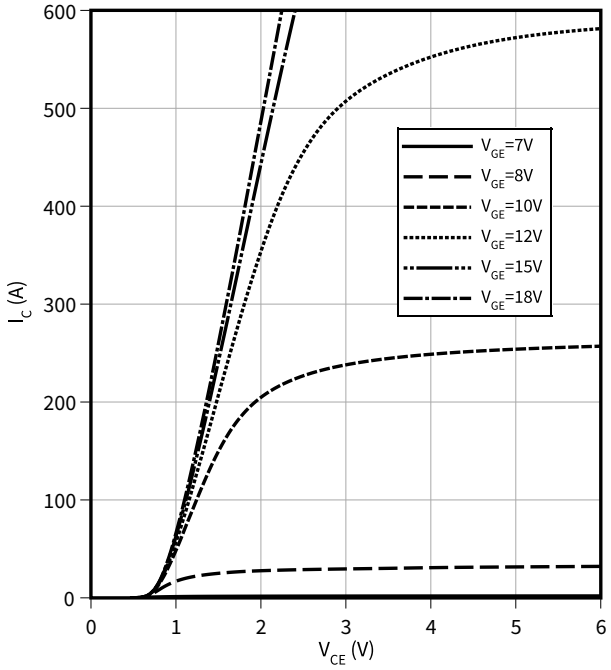
$T_{vj} \leq 175\ °C$, $V_{GE} = 15\ V$



Typical output characteristic

$I_C = f(V_{CE})$

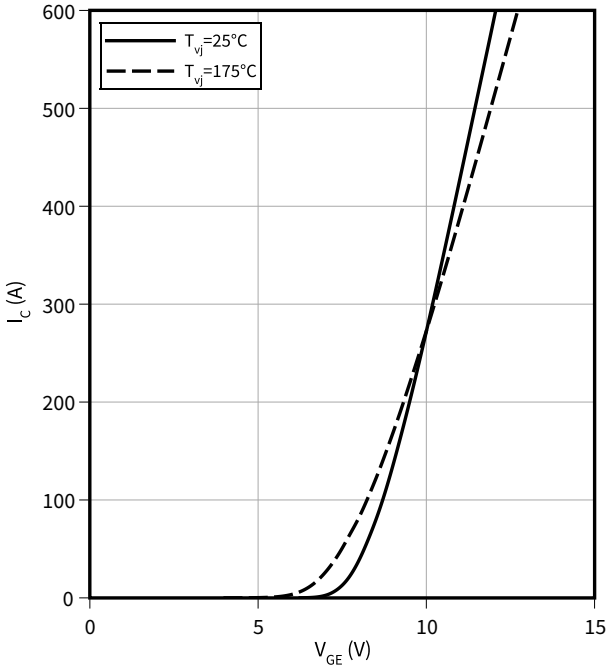
$T_{vj} = 25\ °C$



Typical transfer characteristic

$I_C = f(V_{GE})$

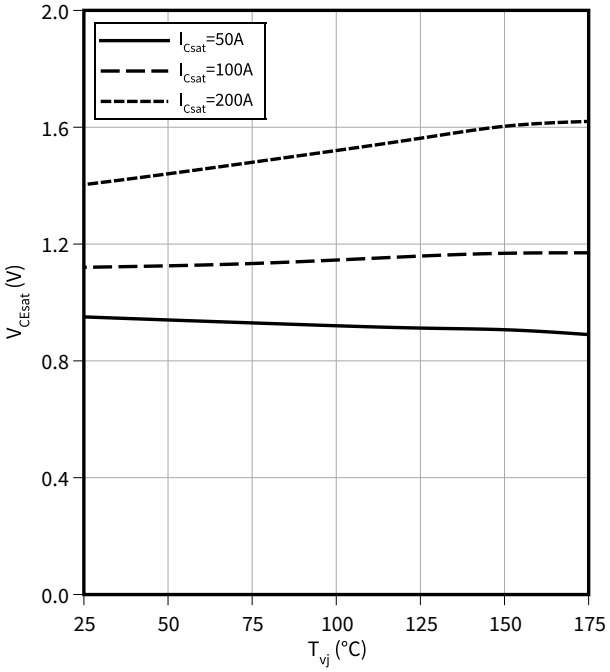
V_{CE} = 20 V



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

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

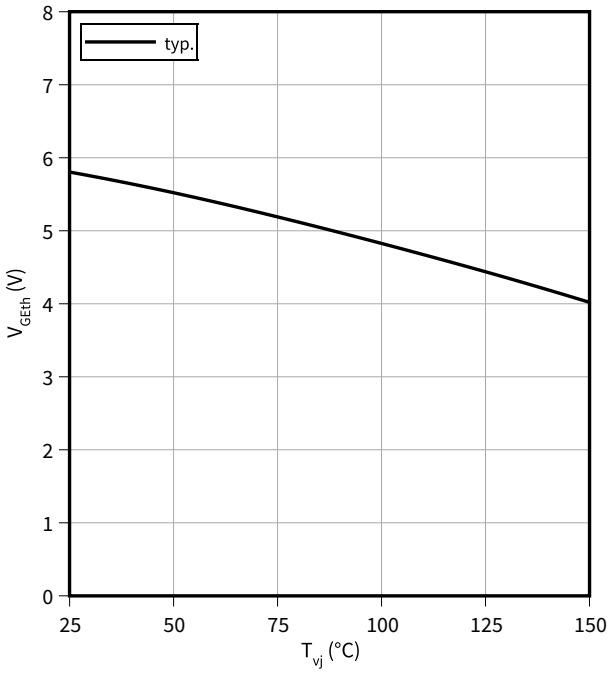
V_{GE} = 15 V



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

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

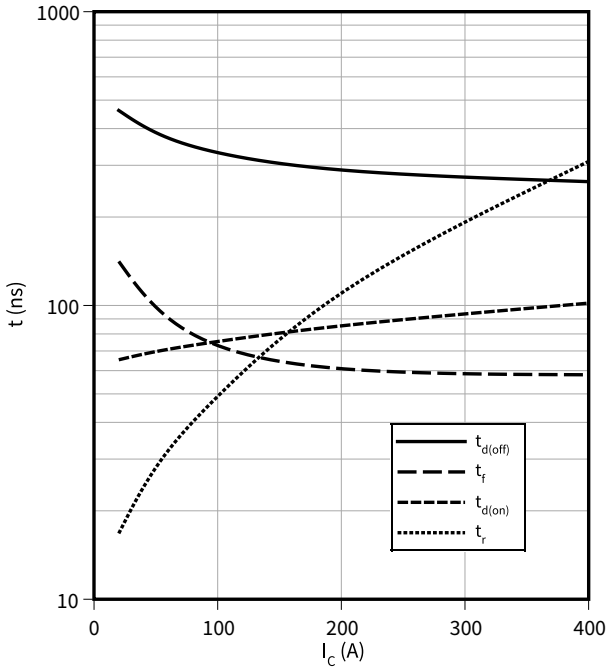
I_C = 2.60 mA



Typical switching times as a function of collector current

$t = f(I_C)$

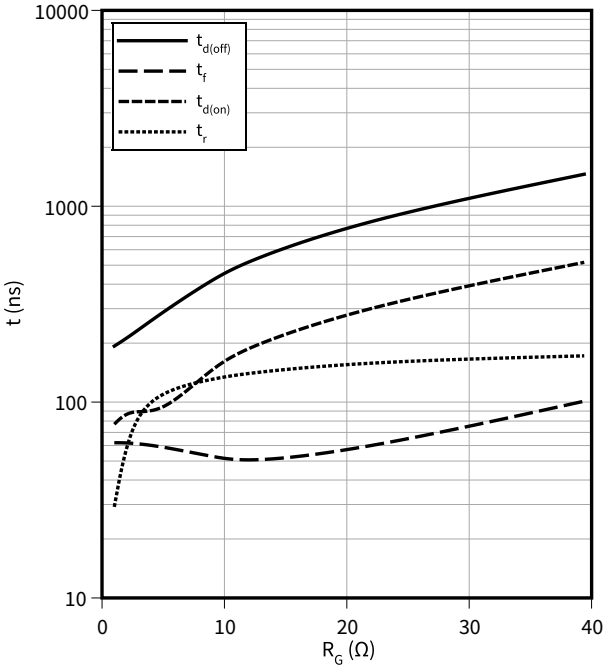
$R_{G(off)}$ = 5 Ω, V_{CE} = 470 V, T_{vj} = 175 °C, V_{GE} = -8/15 V, $R_{G(on)}$ = 5 Ω



Typical switching times as a function of gate resistor

$t = f(R_G)$

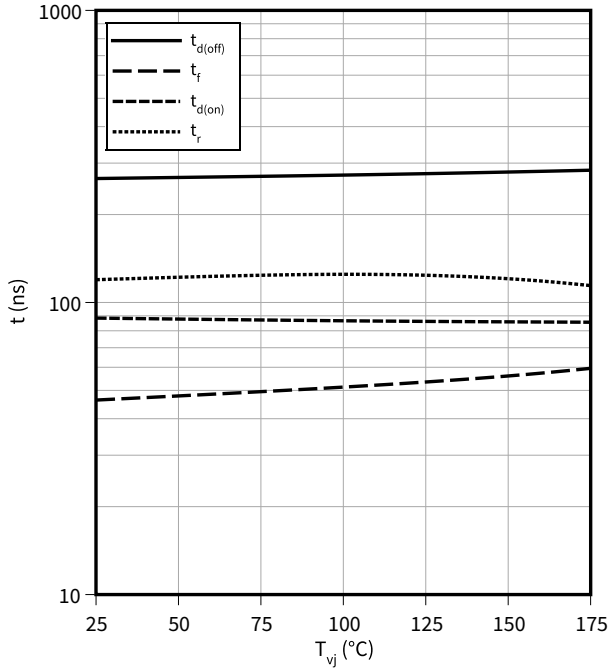
I_C = 200 A, V_{CE} = 470 V, T_{vj} = 175 °C, V_{GE} = -8/15 V



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

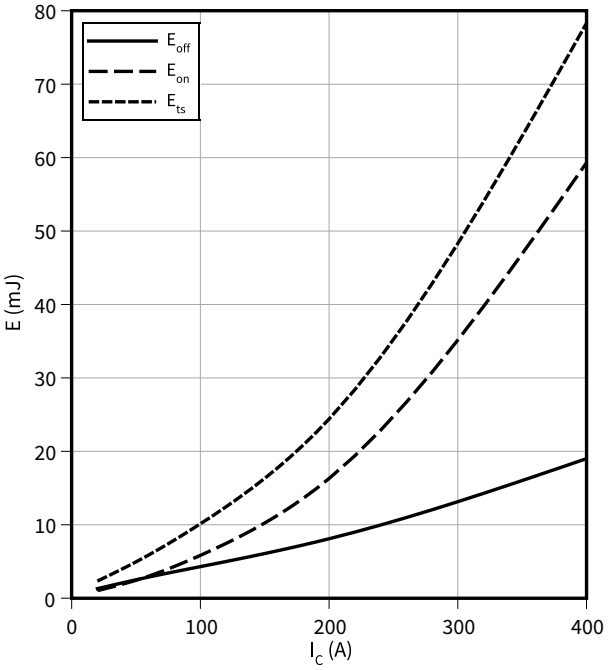
I_C = 200 A, $R_{G(off)}$ = 5.0 Ω, V_{CE} = 470 V, V_{GE} = -8/15 V, $R_{G(on)}$ = 5 Ω



Typical switching energy losses as a function of collector current

$E = f(I_C)$

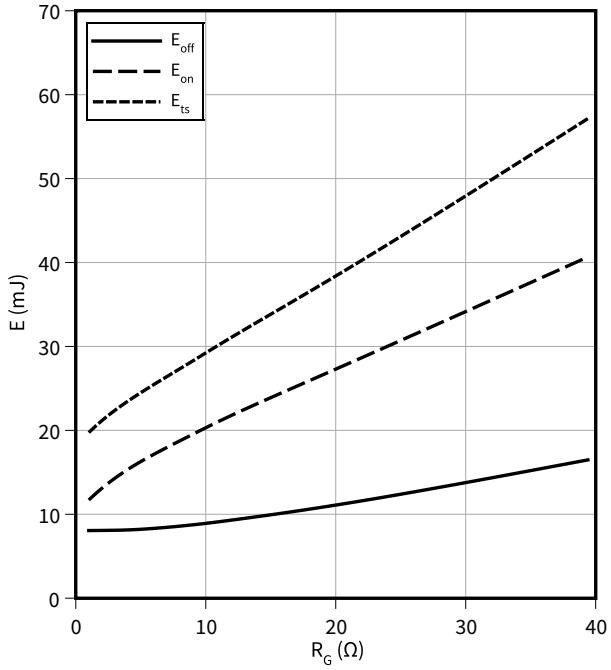
$R_{G(off)}$ = 5 Ω, V_{CE} = 470 V, T_{vj} = 175 °C, V_{GE} = -8/15 V, $R_{G(on)}$ = 5 Ω



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

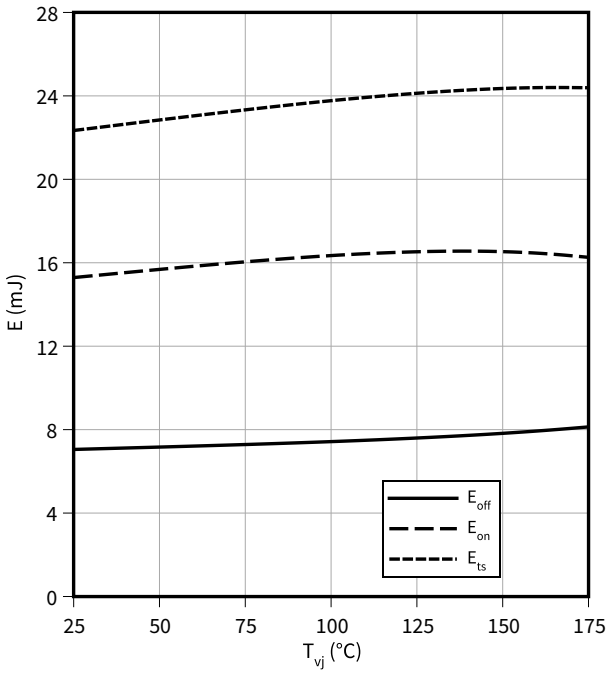
I_C = 200 A, V_{CE} = 470 V, T_{vj} = 175 °C, V_{GE} = -8/15 V



Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

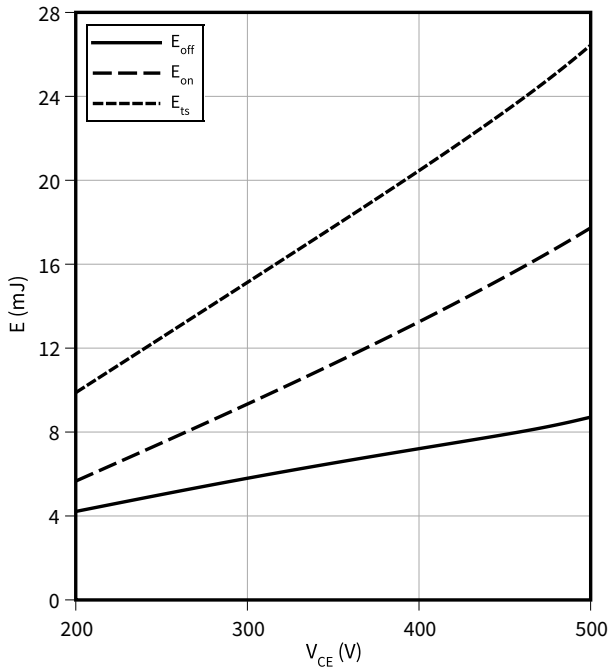
I_C = 200 A, $R_{G(off)}$ = 5.0 Ω, V_{CE} = 470 V, V_{GE} = -8/15 V, $R_{G(on)}$ = 5 Ω



Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$

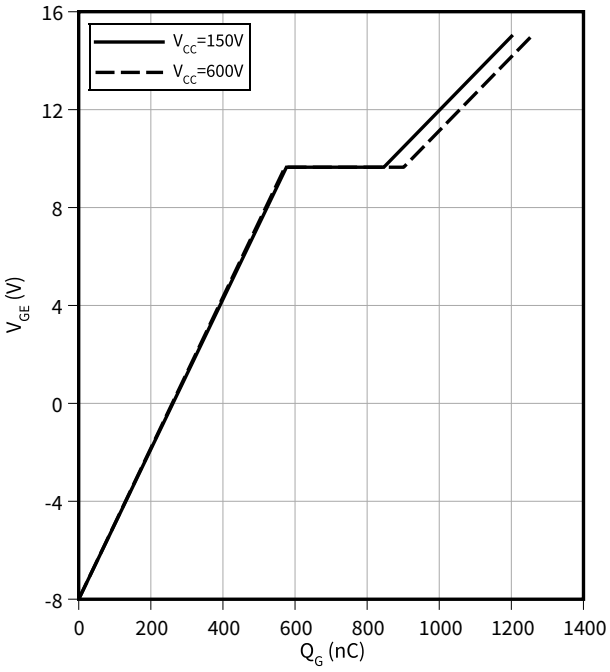
I_C = 200 A, $R_{G(off)}$ = 5 Ω, $T_{vj} \leq$ 175 °C, V_{GE} = -8/15 V, $R_{G(on)}$ = 5 Ω



Typical gate charge

$V_{GE} = f(Q_G)$

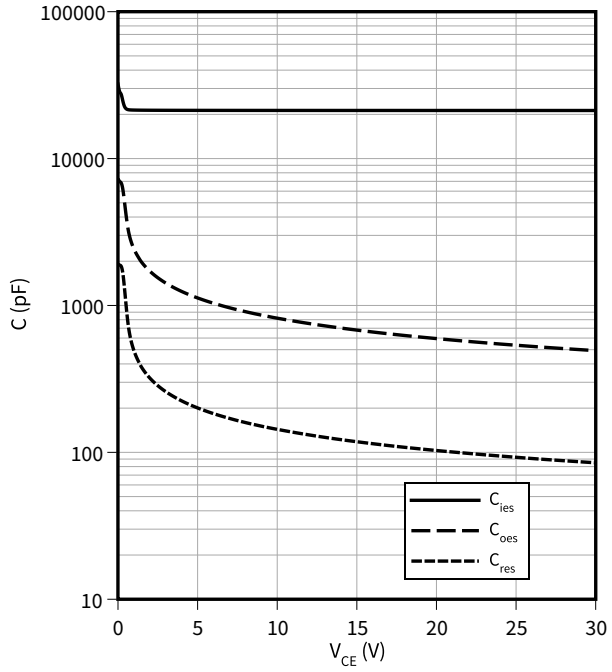
I_C = 200 A



Typical capacitance as a function of collector-emitter voltage

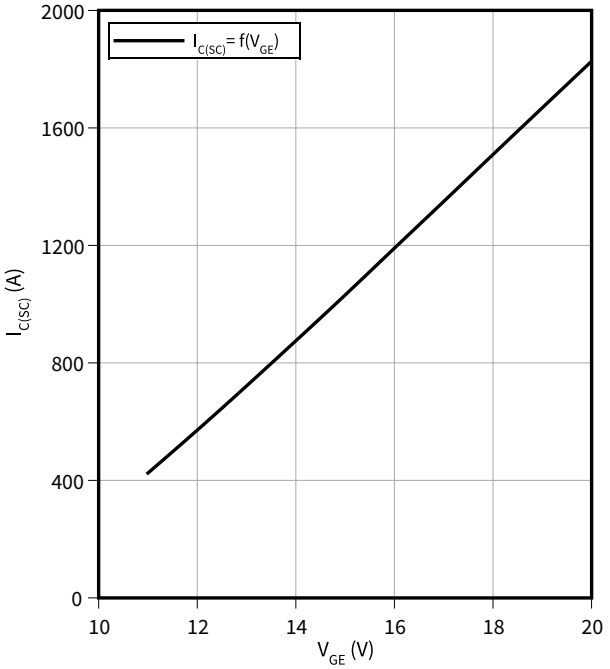
$C = f(V_{CE})$

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



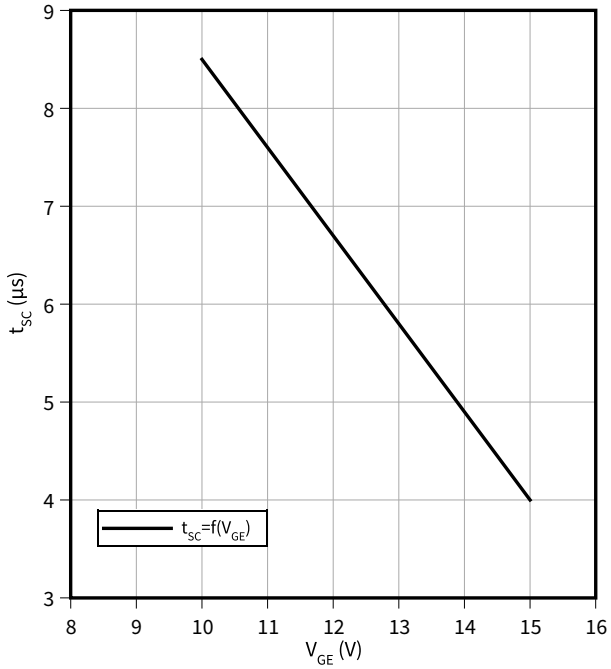
Typical short circuit collector current as a function of gate-emitter voltage

$I_{C(SC)} = f(V_{GE})$
$T_{vj} \leq 175\ °C$, $V_{CC} \leq 470\ V$



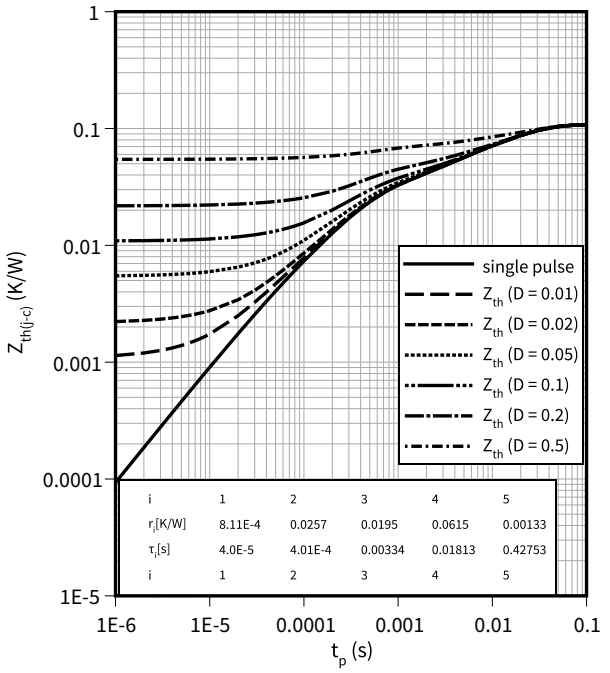
Typical Short circuit withstand time as a function of gate-emitter voltage

$t_{SC} = f(V_{GE})$
$T_{vj} \leq 175\ °C$, $V_{CC} \leq 470\ V$



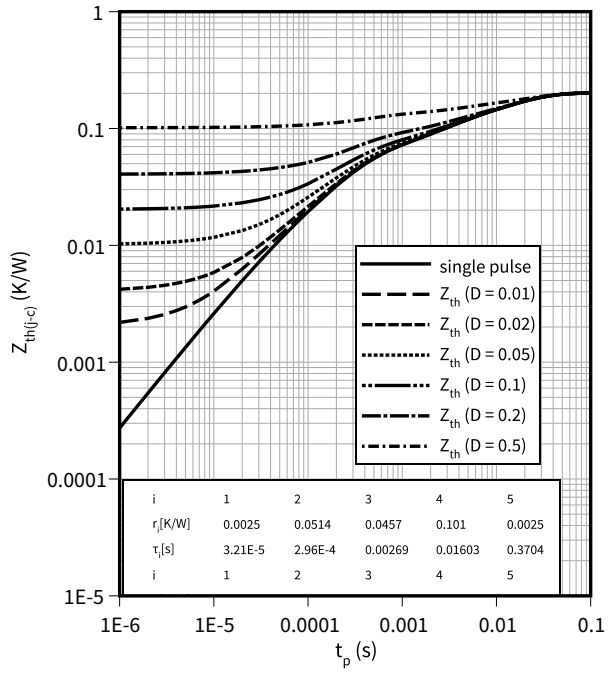
IGBT typical transient thermal impedance as a function of pulse width

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



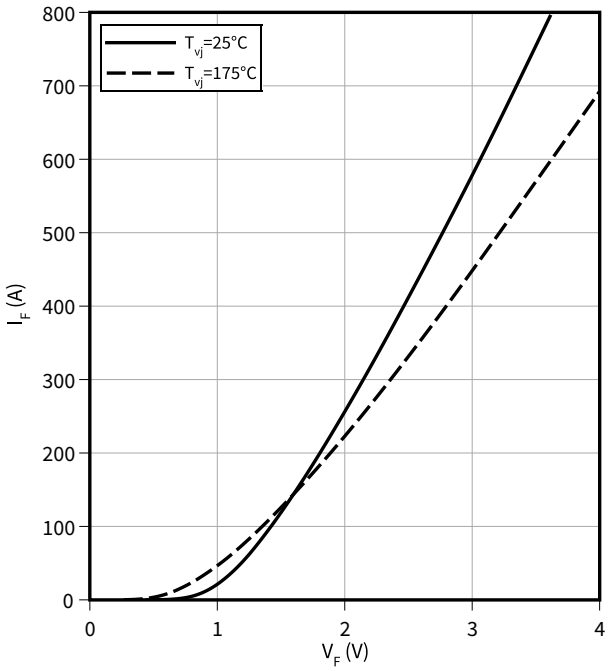
Diode typical transient thermal impedance as a function of pulse width

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



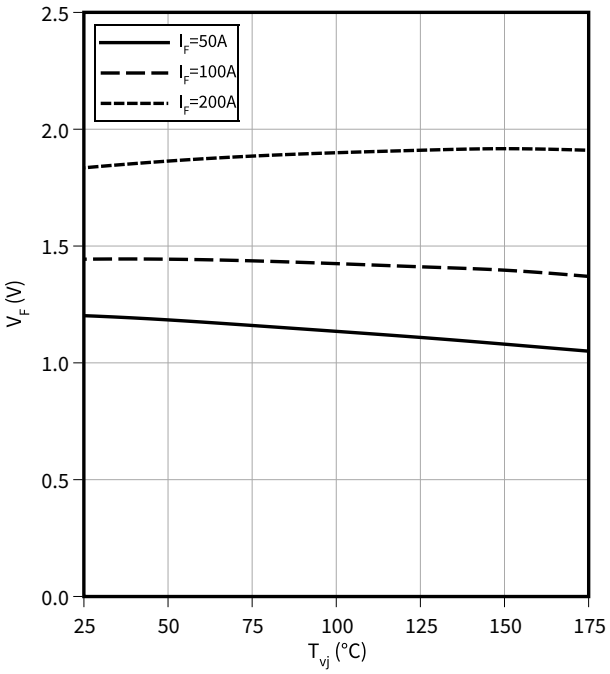
Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



Typical diode forward voltage as a function of junction temperature

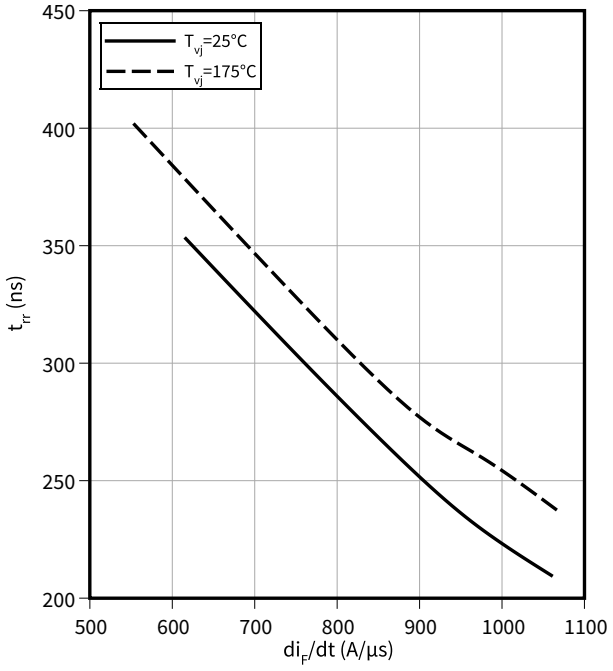
$V_F = f(T_{vj})$



Typical reverse recovery time as a function of diode current slope

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

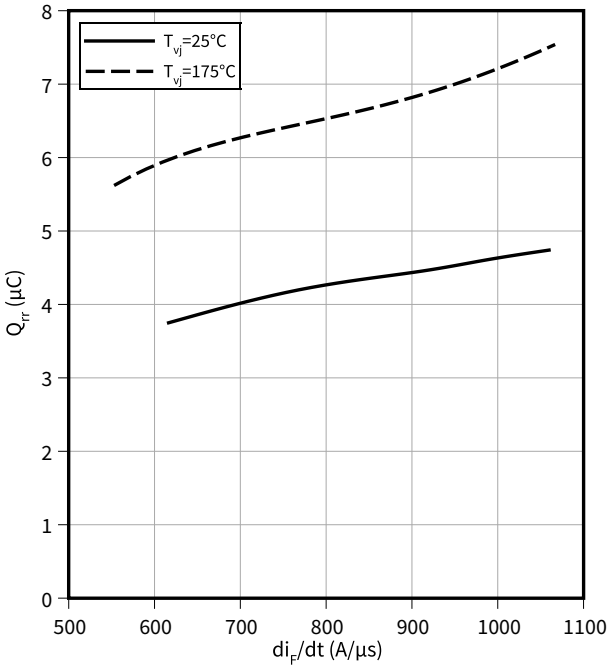
$V_R < 470$ V, $I_F = 200$ A



Typical reverse recovery charge as a function of diode current slope

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

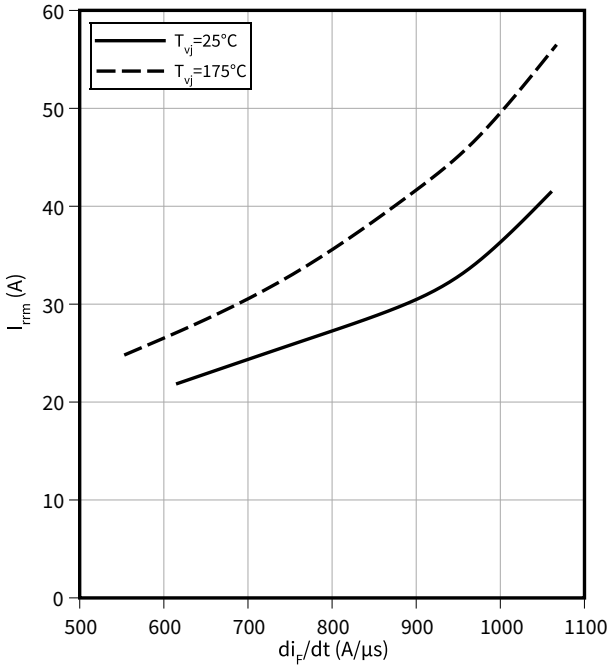
$V_R < 470$ V, $I_F = 200$ A



Typical reverse recovery current as a function of diode current slope

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

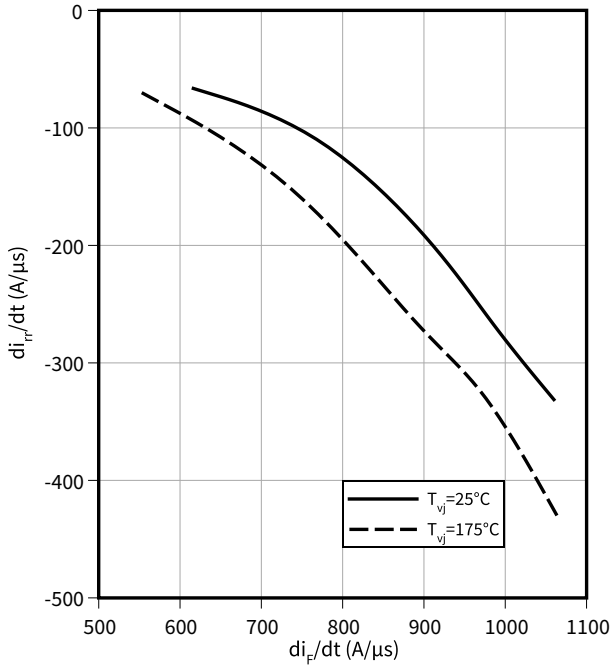
$V_R < 470$ V, $I_F = 200$ A



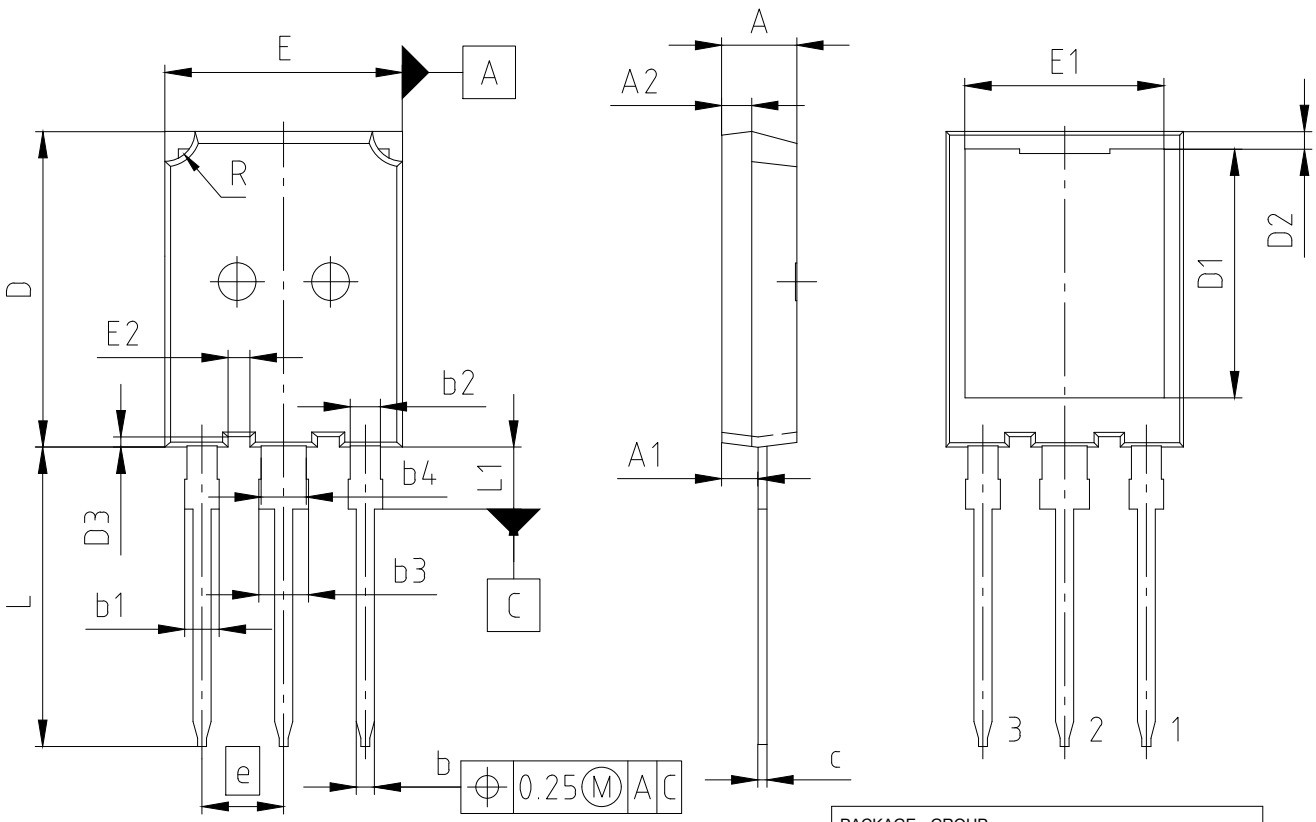
Typical diode peak rate of fall of reverse recovery current as a function of diode current slope

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

$V_R < 470$ V, $I_F = 200$ A



5 Package outlines



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

Figure 1

Revision history

Document revision	Date of release	Description of changes
V0.1	2020-07-16	Target
V0.1	2020-10-09	Target
V0.2	2020-11-02	Updated marking on page1
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
1.00	2022-02-16	Final datasheet
1.10	2022-03-28	Updated Isc 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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