

Short circuit rugged 750 V EDT2 IGBT in reflow-solderable package co-packed with soft and fast recovery diode

Features

- $V_{CE} = 750\text{ V}$
- $I_C = 160\text{ A}$
- Low saturation voltage $V_{CEsat} = 1.4\text{ V}$
- Low switching losses
- Short circuit ruggedness $3\text{ }\mu\text{s}$
- IGBT co-packed with full current, soft and fast recovery diode
- Optimized for hard switching topologies up to 10 KHz
- Package backside suitable for reflow soldering at 245°C , 3 times
- Plating of pins further enable electrical resistance welding
- Complete product spectrum and PSpice Models: <http://www.infineon.com/igbt/>

Potential applications

- CAV Powertrain Control Modules
- General purpose drives (GPD)

Product validation

- Qualified for industrial applications according to the relevant tests of JEDEC47/20/22

Description



Lead-free



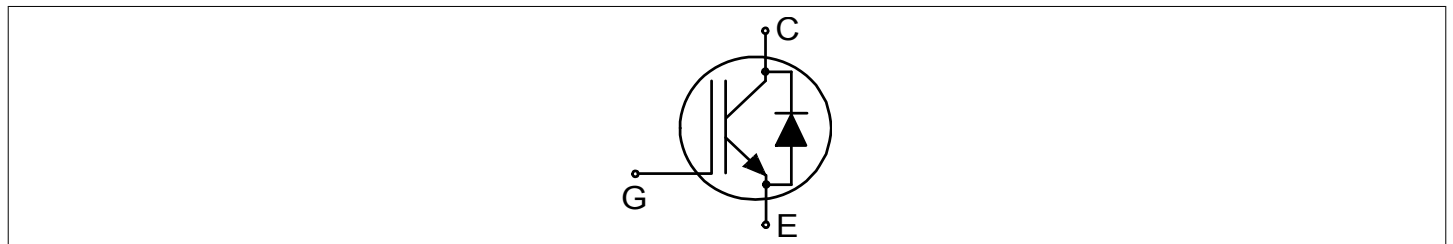
Green



Halogen-free



RoHS



Type	Package	Marking
IKQB160N75CP2	PG-TO247-3-PLUS-NN8.5	K160GCP2

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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}	reflow soldering (MSL1 according to JEDEC J-STA-020)			245	°C
Thermal resistance, junction-ambient	$R_{th(j-a)}$				40	K/W
IGBT thermal resistance, junction-case	$R_{th(j-c)}$				0.2	K/W
Diode thermal resistance, junction-case	$R_{th(j-c)}$				0.36	K/W

2 IGBT

Table 2 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit	
Collector-emitter voltage	V_{CE}	$T_{vj} \geq 25\text{ °C}$	750	V	
DC collector current, limited by T_{vjmax}	I_C	limited by bondwire	$T_c = 25\text{ °C}$	200	A
			$T_c = 125\text{ °C}$	160	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}		480	A	
Turn-off safe operating area		$V_{CE} \leq 750\text{ V}, T_{vj} \leq 175\text{ °C}$	480	A	
Gate-emitter voltage	V_{GE}		± 20	V	
Transient gate-emitter voltage	V_{GE}	$t_p = 10\text{ }\mu\text{s}, D < 0.01$	± 30	V	
Short-circuit withstand time	t_{SC}	$V_{CC} \leq 450\text{ V}, V_{GE} = 15\text{ V}$, Allowed number of short circuits < 1000, Time between short circuits $\geq 1.0\text{ s}, T_{vj} = 125\text{ °C}$	3	μs	
Power dissipation	P_{tot}		$T_c = 25\text{ °C}$	750	W
			$T_c = 125\text{ °C}$	250	

Table 3 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	V_{CEsat}	$I_C = 160\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25\text{ °C}$		1.4	1.65	V
			$T_{vj} = 175\text{ °C}$		1.7		
Gate-emitter threshold voltage	V_{GETh}	$I_C = 2.15\text{ mA}, V_{CE} = V_{GE}$		5	5.8	6.5	V
Zero gate-voltage collector current	I_{CES}	$V_{CE} = 750\text{ V}, V_{GE} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$			200	μA
			$T_{vj} = 175\text{ °C}$		6000		
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\text{ V}, V_{GE} = 20\text{ V}$				100	nA
Transconductance	g_{fs}	$I_C = 160\text{ A}, V_{CE} = 20\text{ V}$			118		S
Input capacitance	C_{ies}	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$			16500		pF
Output capacitance	C_{oes}	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$			435		pF
Reverse transfer capacitance	C_{res}	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$			75		pF
Gate charge	Q_G	$I_C = 160\text{ A}, V_{GE} = 15\text{ V}, V_{CC} = 600\text{ V}$			610		nC
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 450\text{ V}, V_{GE} = 0/15\text{ V}, R_{G(on)} = 4.8\ \Omega, R_{G(off)} = 4.8\ \Omega, L_\sigma = 30\text{ nH}, C_\sigma = 144\text{ pF}$	$T_{vj} = 25\text{ °C}, I_C = 160\text{ A}$		72		ns
			$T_{vj} = 175\text{ °C}, I_C = 160\text{ A}$		69		
Rise time (inductive load)	t_r	$V_{CC} = 450\text{ V}, V_{GE} = 0/15\text{ V}, R_{G(on)} = 4.8\ \Omega, R_{G(off)} = 4.8\ \Omega, L_\sigma = 30\text{ nH}, C_\sigma = 144\text{ pF}$	$T_{vj} = 25\text{ °C}, I_C = 160\text{ A}$		73		ns
			$T_{vj} = 175\text{ °C}, I_C = 160\text{ A}$		69		
Turn-off delay time	$t_{d(off)}$	$V_{CC} = 450\text{ V}, V_{GE} = 0/15\text{ V}, R_{G(on)} = 4.8\ \Omega, R_{G(off)} = 4.8\ \Omega, L_\sigma = 30\text{ nH}, C_\sigma = 144\text{ pF}$	$T_{vj} = 25\text{ °C}, I_C = 160\text{ A}$		324		ns
			$T_{vj} = 175\text{ °C}, I_C = 160\text{ A}$		395		
Fall time (inductive load)	t_f	$V_{CC} = 450\text{ V}, V_{GE} = 0/15\text{ V}, R_{G(on)} = 4.8\ \Omega, R_{G(off)} = 4.8\ \Omega, L_\sigma = 30\text{ nH}, C_\sigma = 144\text{ pF}$	$T_{vj} = 25\text{ °C}, I_C = 160\text{ A}$		40		ns
			$T_{vj} = 175\text{ °C}, I_C = 160\text{ A}$		53		
Turn-on energy	E_{on}	$V_{CC} = 450\text{ V}, V_{GE} = 0/15\text{ V}, R_{G(on)} = 4.8\ \Omega, R_{G(off)} = 4.8\ \Omega, L_\sigma = 30\text{ nH}, C_\sigma = 144\text{ pF}$	$T_{vj} = 25\text{ °C}, I_C = 160\text{ A}$		9.7		mJ
			$T_{vj} = 175\text{ °C}, I_C = 160\text{ A}$		12.5		

(table continues...)

Table 3 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit	
			Min.	Typ.	Max.		
Turn-off energy	E_{off}	$V_{CC} = 450\text{ V}, V_{GE} = 0/15\text{ V},$ $R_{G(on)} = 4.8\ \Omega,$ $R_{G(off)} = 4.8\ \Omega, L_{\sigma} = 30\text{ nH},$ $C_{\sigma} = 144\text{ pF}$	$T_{vj} = 25\text{ }^{\circ}\text{C},$ $I_C = 160\text{ A}$		5.2		mJ
			$T_{vj} = 175\text{ }^{\circ}\text{C},$ $I_C = 160\text{ A}$		7.6		
Total switching energy	E_{ts}	$V_{CC} = 450\text{ V}, V_{GE} = 0/15\text{ V},$ $R_{G(on)} = 4.8\ \Omega,$ $R_{G(off)} = 4.8\ \Omega, L_{\sigma} = 30\text{ nH},$ $C_{\sigma} = 144\text{ pF}$	$T_{vj} = 25\text{ }^{\circ}\text{C},$ $I_C = 160\text{ A}$		14.9		mJ
			$T_{vj} = 175\text{ }^{\circ}\text{C},$ $I_C = 160\text{ A}$		20.1		
Operating junction temperature	T_{vj}		-40		175	$^{\circ}\text{C}$	

Note: Electrical Characteristic, at $T_{vj} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified.

3 Diode

Table 4 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit	
Repetitive peak reverse voltage	V_{RRM}	$T_{vj} \leq 25\text{ }^{\circ}\text{C}$	750	V	
Diode forward current, limited by T_{vjmax}	I_F		$T_C = 25\text{ }^{\circ}\text{C}$	200	A
			$T_C = 65\text{ }^{\circ}\text{C}$	160	
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpulse}		480	A	
Power dissipation	P_{tot}		$T_C = 25\text{ }^{\circ}\text{C}$	417	W
			$T_C = 125\text{ }^{\circ}\text{C}$	139	

Table 5 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit	
			Min.	Typ.	Max.		
Diode forward voltage	V_F	$I_F = 160\text{ A}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$		1.8	2	V
			$T_{vj} = 175\text{ }^{\circ}\text{C}$		1.9		
Diode reverse recovery time	t_{rr}	$V_R = 450\text{ V}$	$T_{vj} = 25\text{ }^{\circ}\text{C},$ $I_F = 160\text{ A},$ $-di_F/dt = 1000\text{ A}/\mu\text{s}$		255		ns
			$T_{vj} = 175\text{ }^{\circ}\text{C},$ $I_F = 160\text{ A},$ $-di_F/dt = 1000\text{ A}/\mu\text{s}$		373		

(table continues...)

Table 5 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode reverse recovery charge	Q_{rr}	$V_R = 450 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C},$ $I_F = 160 \text{ A},$ $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		4.2		μC
					12.3		
Diode peak reverse recovery current	I_{rrm}	$V_R = 450 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C},$ $I_F = 160 \text{ A},$ $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		29.6		A
					56.7		
Diode peak rate of fall of reverse recovery current	di_{rr}/dt	$V_R = 450 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C},$ $I_F = 160 \text{ A},$ $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		265		$\text{A}/\mu\text{s}$
					283		
Operating junction temperature	T_{vj}			-40		175	$^\circ\text{C}$

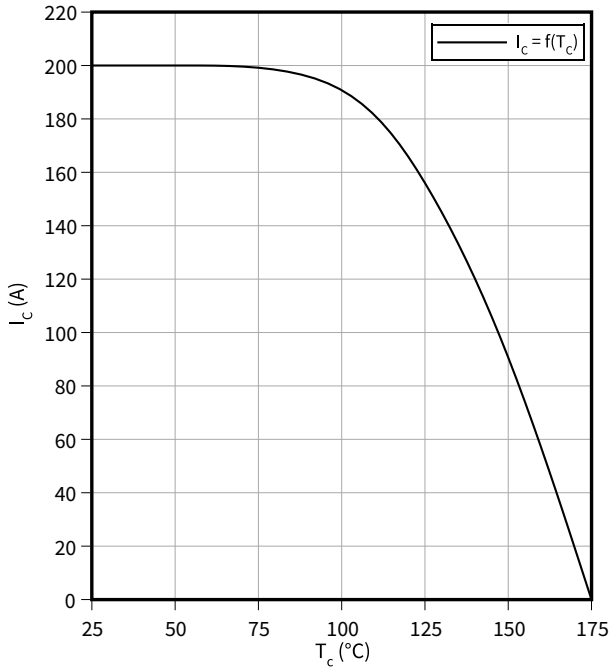
Note: For optimum lifetime and reliability, Infineon recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.

4 Characteristics diagrams

Collector current as a function of case temperature

$$I_C = f(T_C)$$

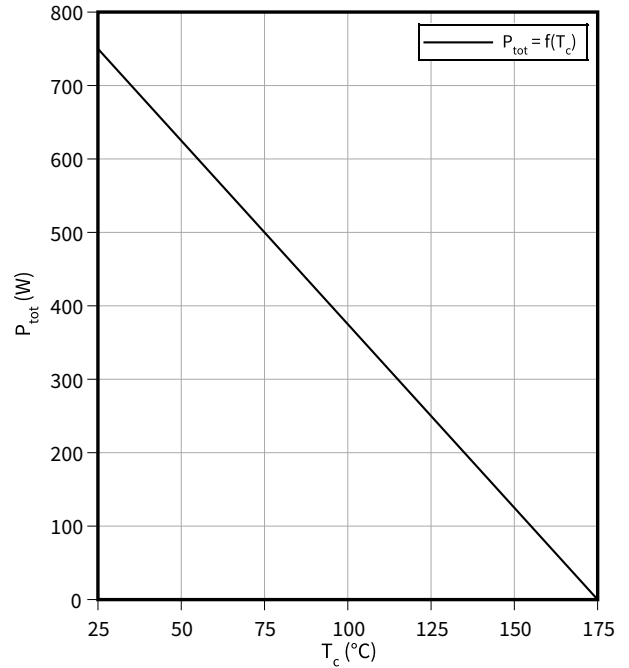
$T_{vj} \leq 175\text{ °C}, V_{GE} \geq 15\text{ V}$



Power dissipation as a function of case temperature

$$P_{tot} = f(T_C)$$

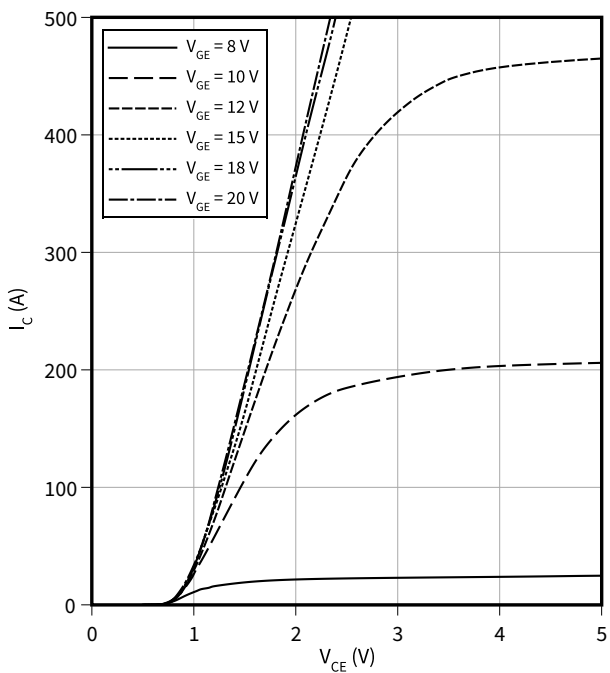
$T_{vj} \leq 175\text{ °C}$



Typical output characteristic

$$I_C = f(V_{CE})$$

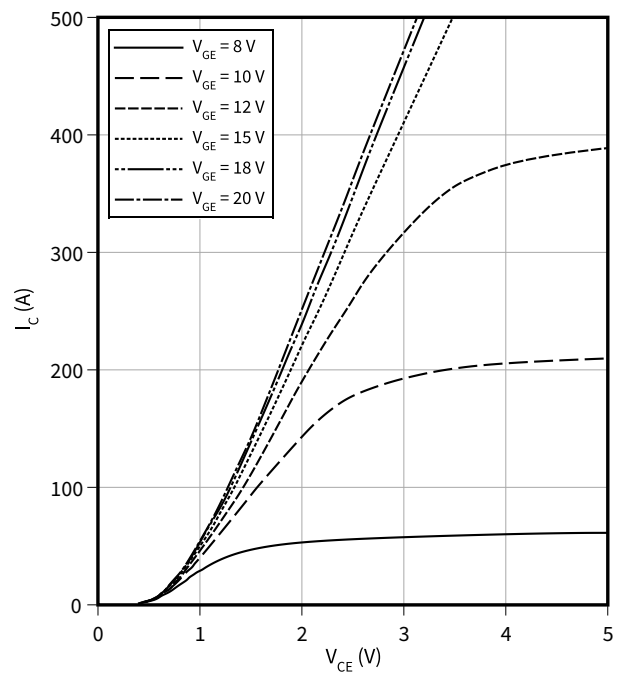
$T_{vj} = 25\text{ °C}$



Typical output characteristic

$$I_C = f(V_{CE})$$

$T_{vj} = 175\text{ °C}$

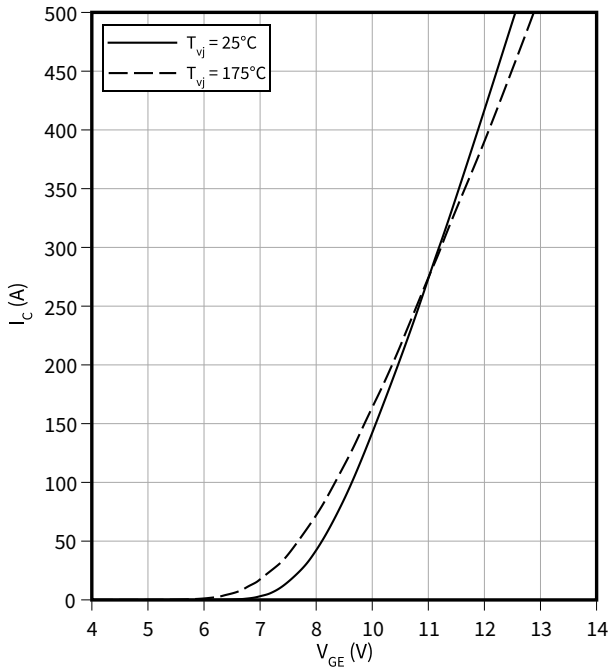


4 Characteristics diagrams

Typical transfer characteristic

$I_C = f(V_{GE})$

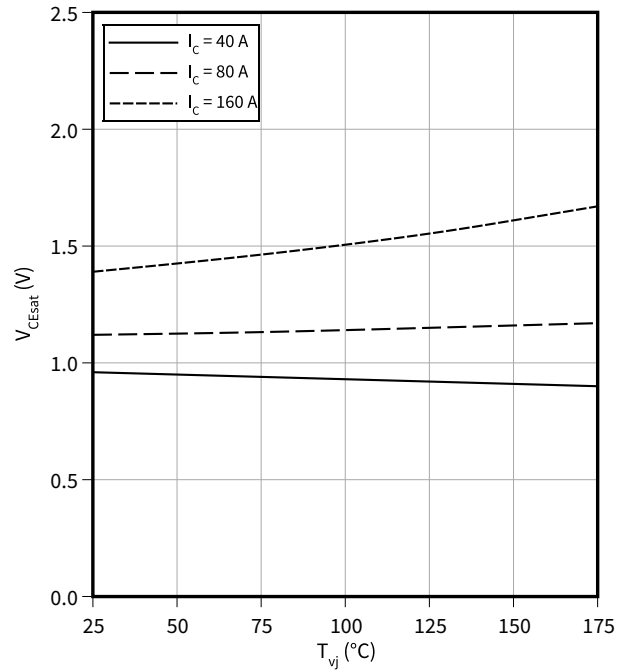
$V_{CE} = 20 \text{ V}$



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

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

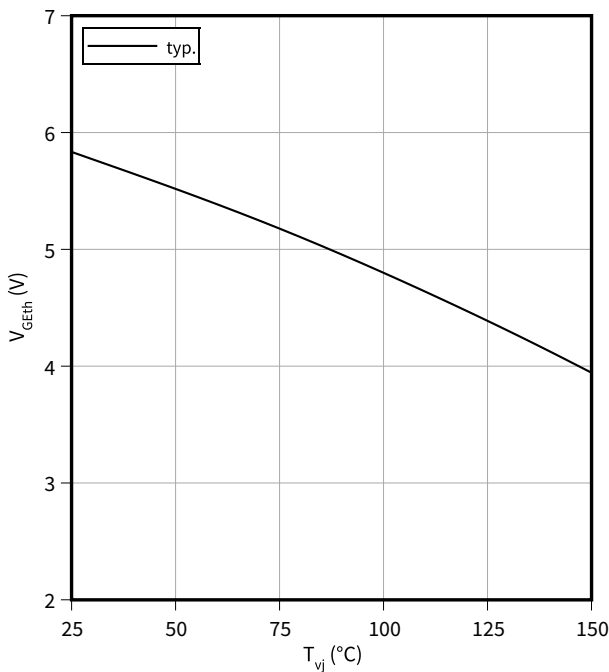
$V_{GE} = 15 \text{ V}$



Gate-emitter threshold voltage as a function of junction temperature

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

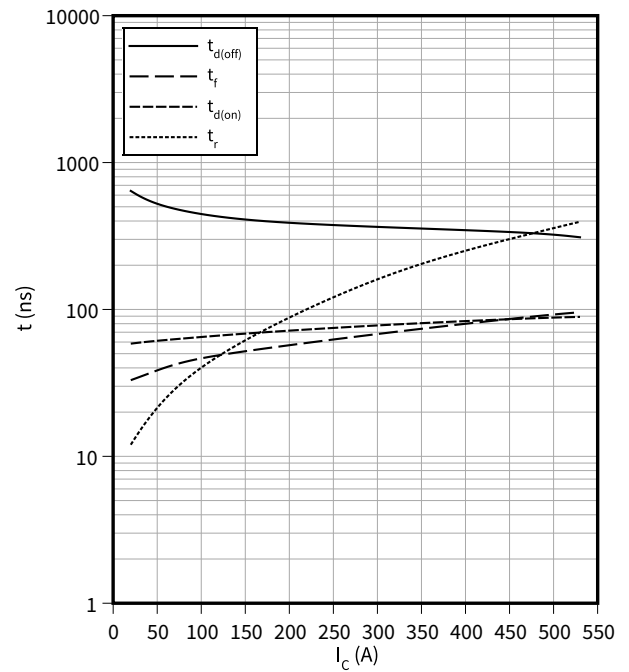
$I_C = 2.15 \text{ mA}$



Typical switching times as a function of collector current

$t = f(I_C)$

$V_{CC} = 450 \text{ V}, T_{vj} = 175 \text{ °C}, V_{GE} = 0/15 \text{ V}, R_G = 4.8 \text{ } \Omega$

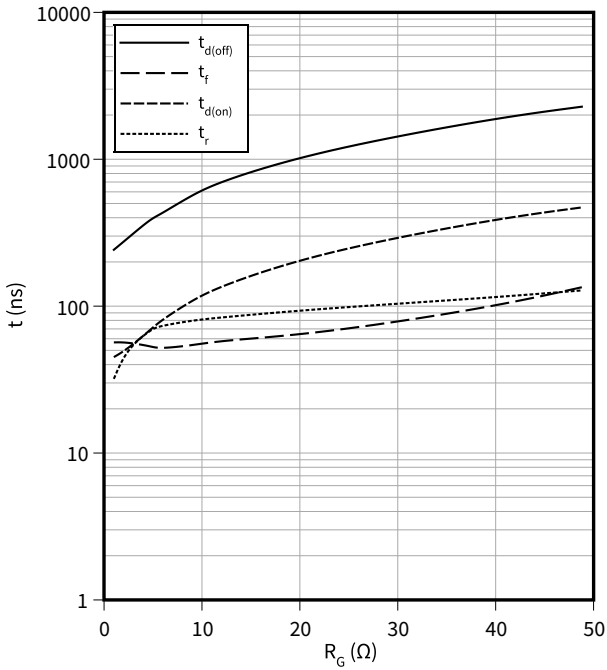


4 Characteristics diagrams

Typical switching times as a function of gate resistor

$t = f(R_G)$

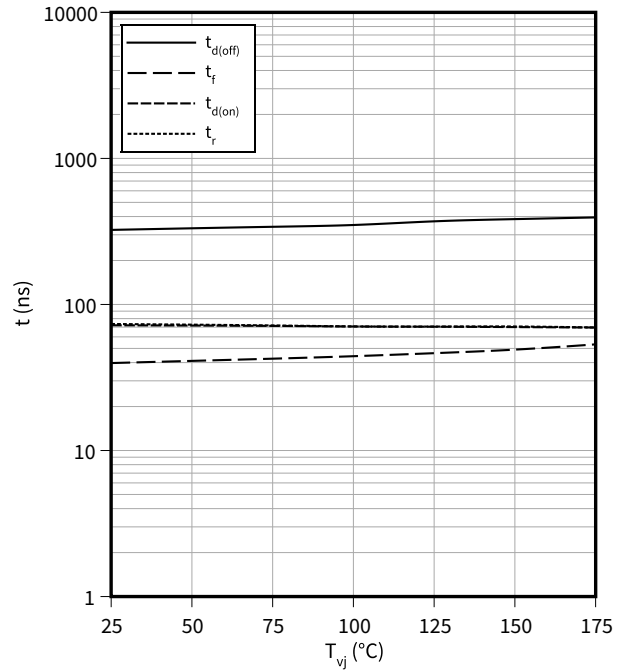
$I_C = 160 \text{ A}, V_{CC} = 450 \text{ V}, T_{vj} = 175 \text{ }^\circ\text{C}, V_{GE} = 0/15 \text{ V}$



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

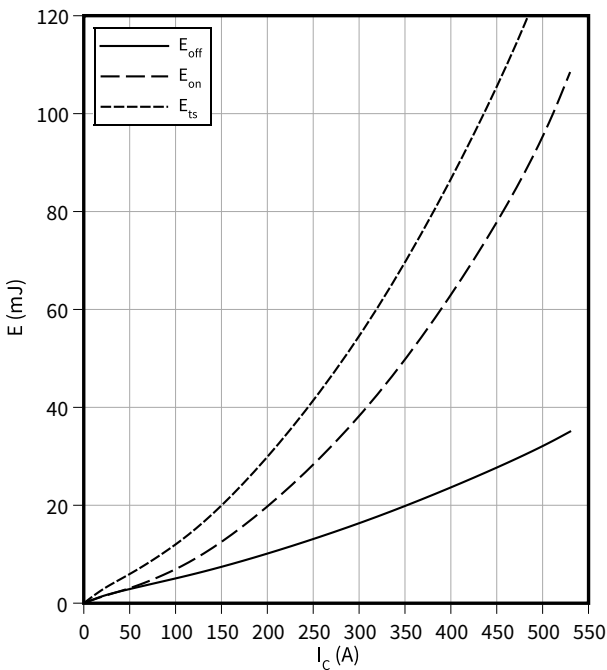
$I_C = 160 \text{ A}, V_{CC} = 450 \text{ V}, V_{GE} = 0/15 \text{ V}, R_G = 4.8 \text{ } \Omega$



Typical switching energy losses as a function of collector current

$E = f(I_C)$

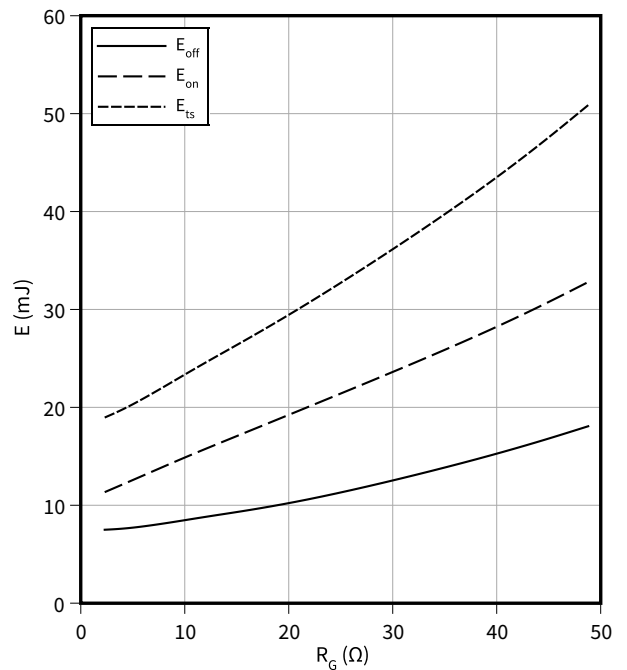
$V_{CC} = 450 \text{ V}, T_{vj} = 175 \text{ }^\circ\text{C}, V_{GE} = 0/15 \text{ V}, R_G = 4.8 \text{ } \Omega$



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

$I_C = 160 \text{ A}, V_{CC} = 450 \text{ V}, T_{vj} = 175 \text{ }^\circ\text{C}, V_{GE} = 0/15 \text{ V}$

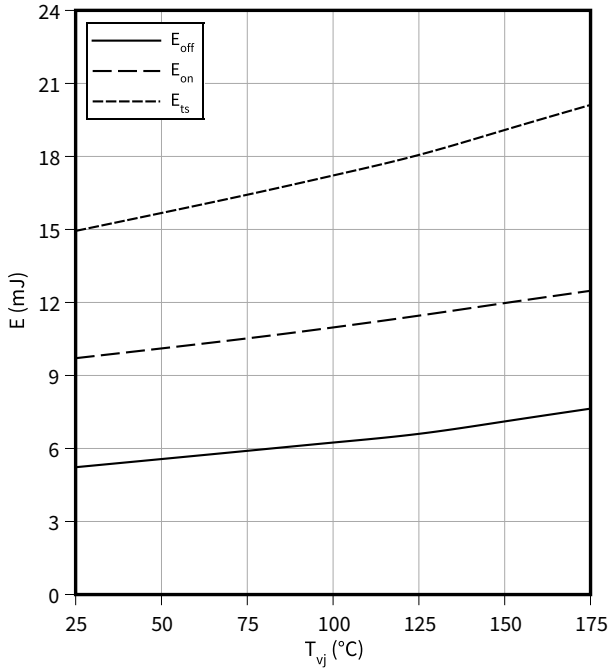


4 Characteristics diagrams

Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

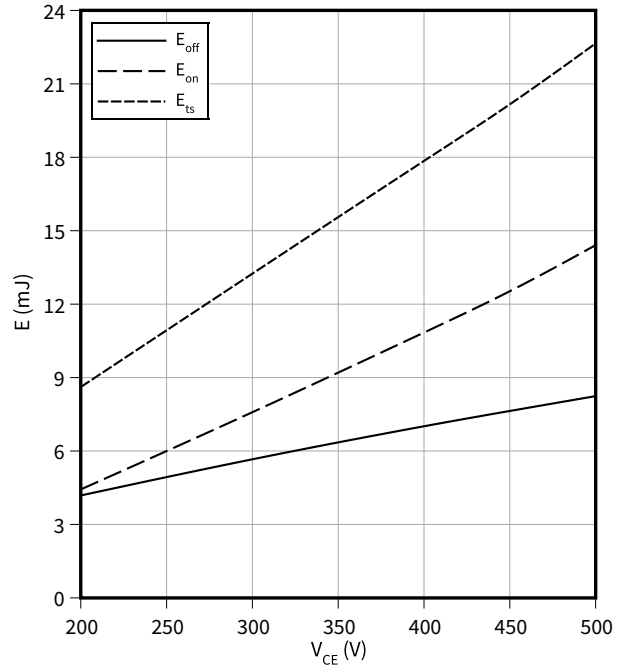
$I_C = 160\text{ A}$, $V_{CC} = 450\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_G = 4.8\ \Omega$



Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$

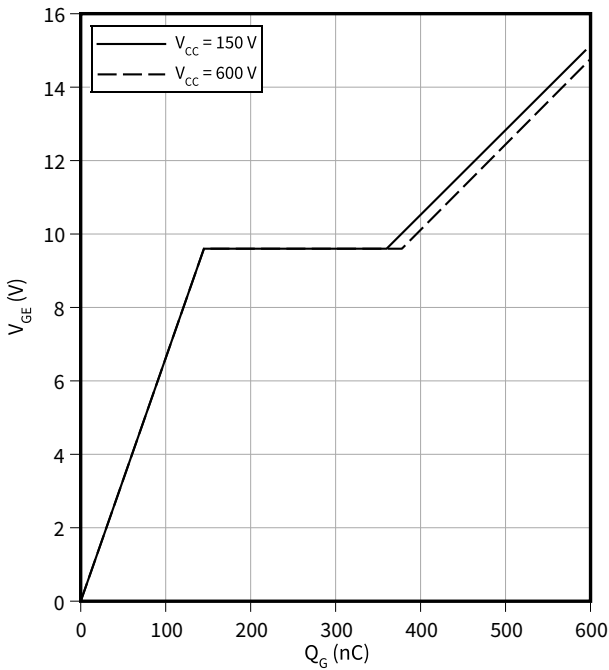
$I_C = 160\text{ A}$, $V_{GE} = 0/15\text{ V}$, $T_{vj} = 175\text{ °C}$, $R_G = 4.8\ \Omega$



Typical gate charge

$V_{GE} = f(Q_G)$

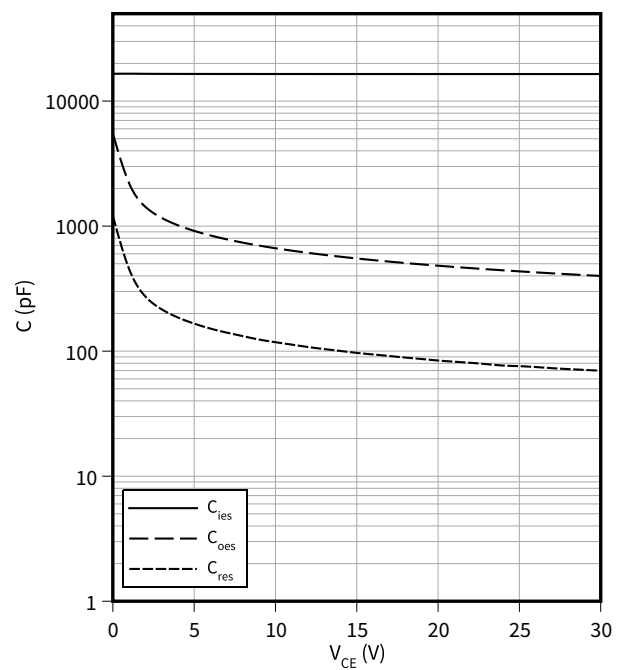
$I_C = 160\text{ A}$



Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE})$

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

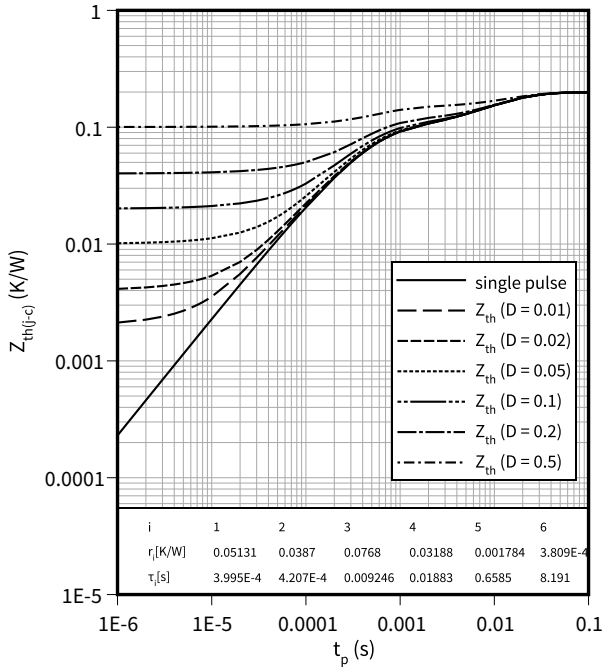


4 Characteristics diagrams

IGBT transient thermal impedance as a function of pulse width

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

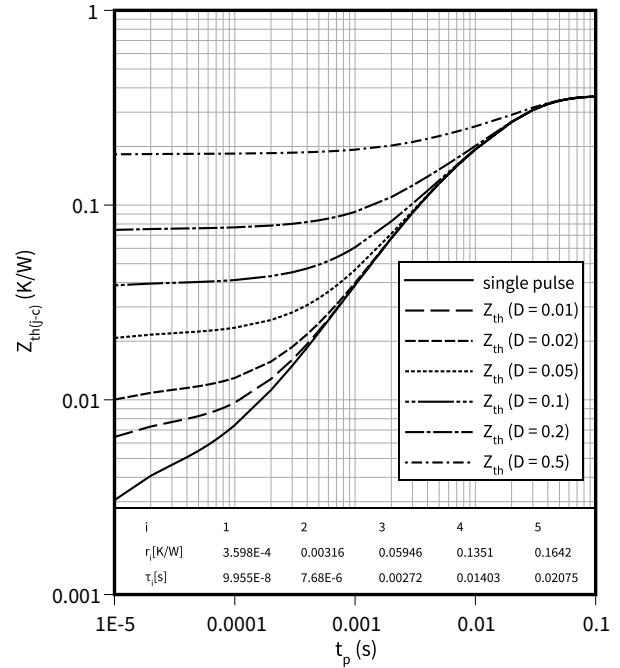
$$D = t_p/T$$



Diode transient thermal impedance as a function of pulse width

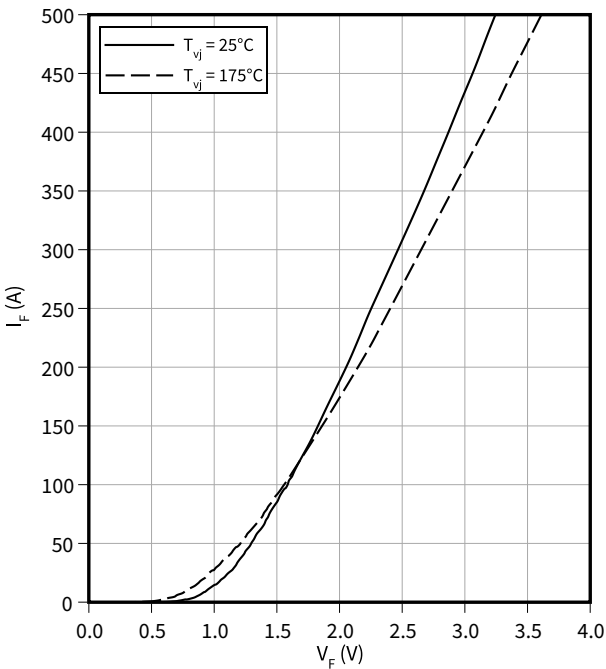
$$Z_{th(j-c)} = f(t_p)$$

$$D = t_p/T$$



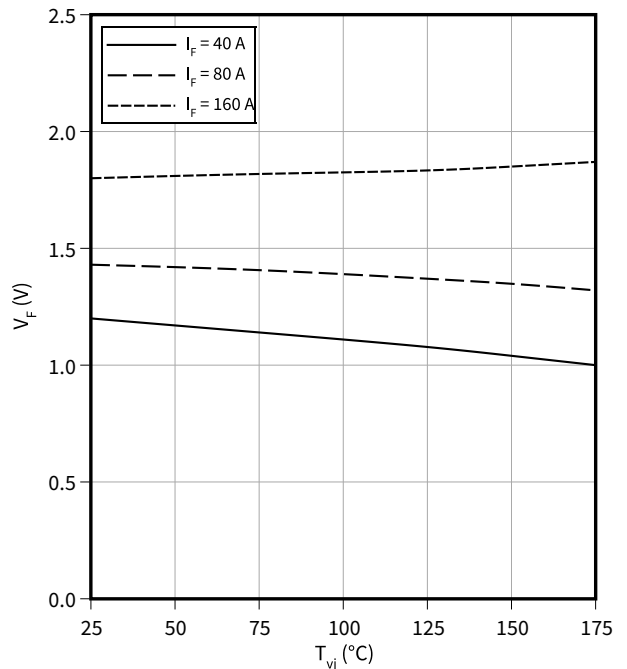
Typical diode forward current as a function of forward voltage

$$I_F = f(V_F)$$



Typical diode forward voltage as a function of junction temperature

$$V_F = f(T_{vj})$$

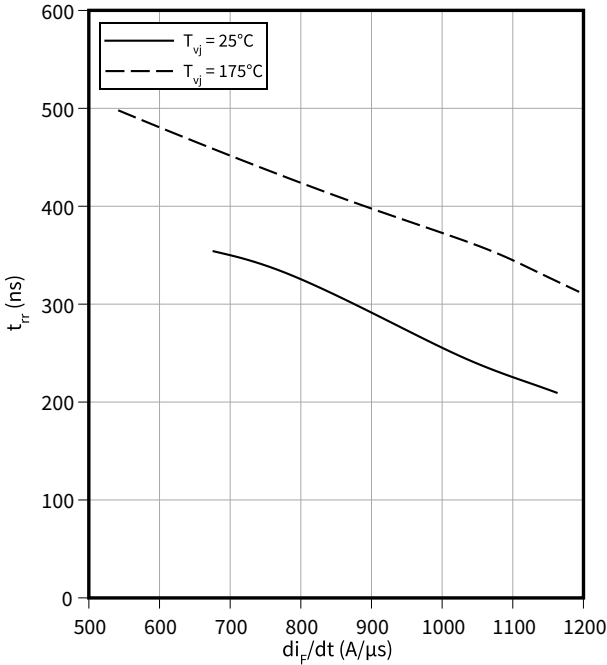


4 Characteristics diagrams

Typical reverse recovery time as a function of diode current slope

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

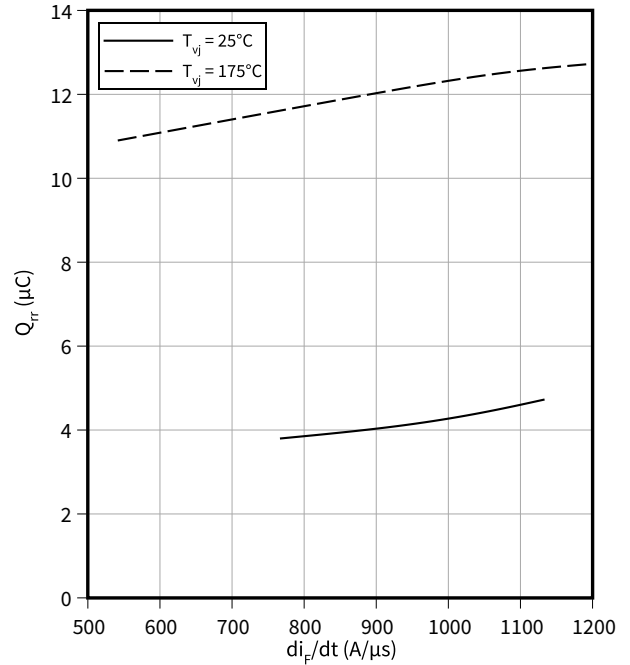
$V_R = 450 \text{ V}, I_F = 160 \text{ A}$



Typical reverse recovery charge as a function of diode current slope

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

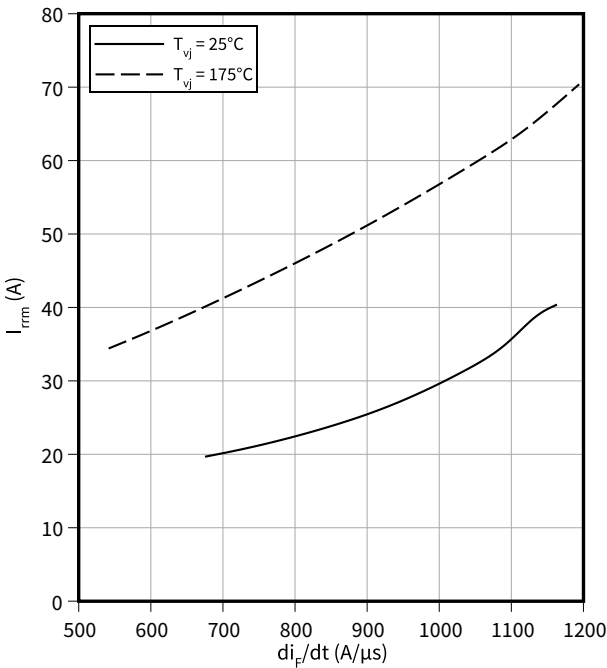
$V_R = 450 \text{ V}, I_F = 160 \text{ A}$



Typical reverse recovery current as a function of diode current slope

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

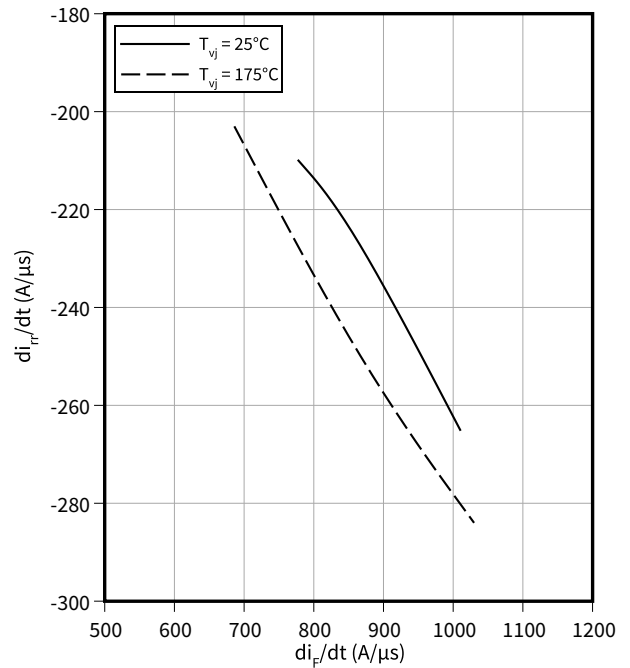
$V_R = 450 \text{ V}, I_F = 160 \text{ A}$



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

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

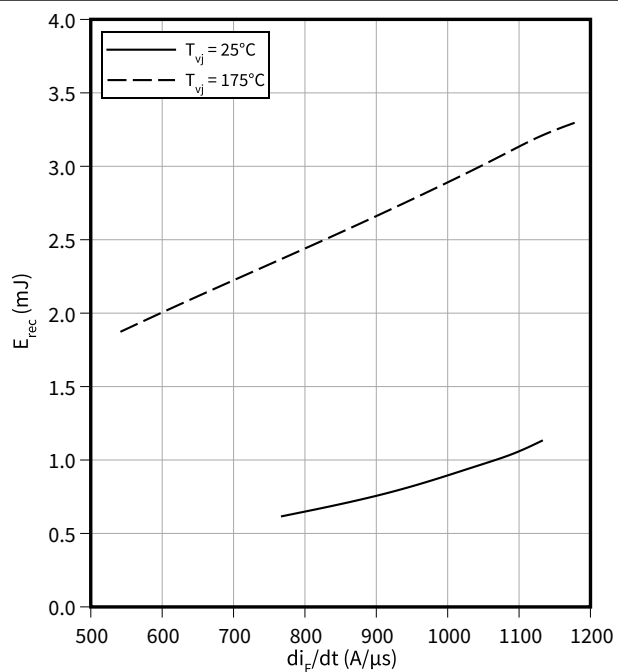
$V_R = 450 \text{ V}, I_F = 160 \text{ A}$



Typical reverse energy losses as a function of diode current slope

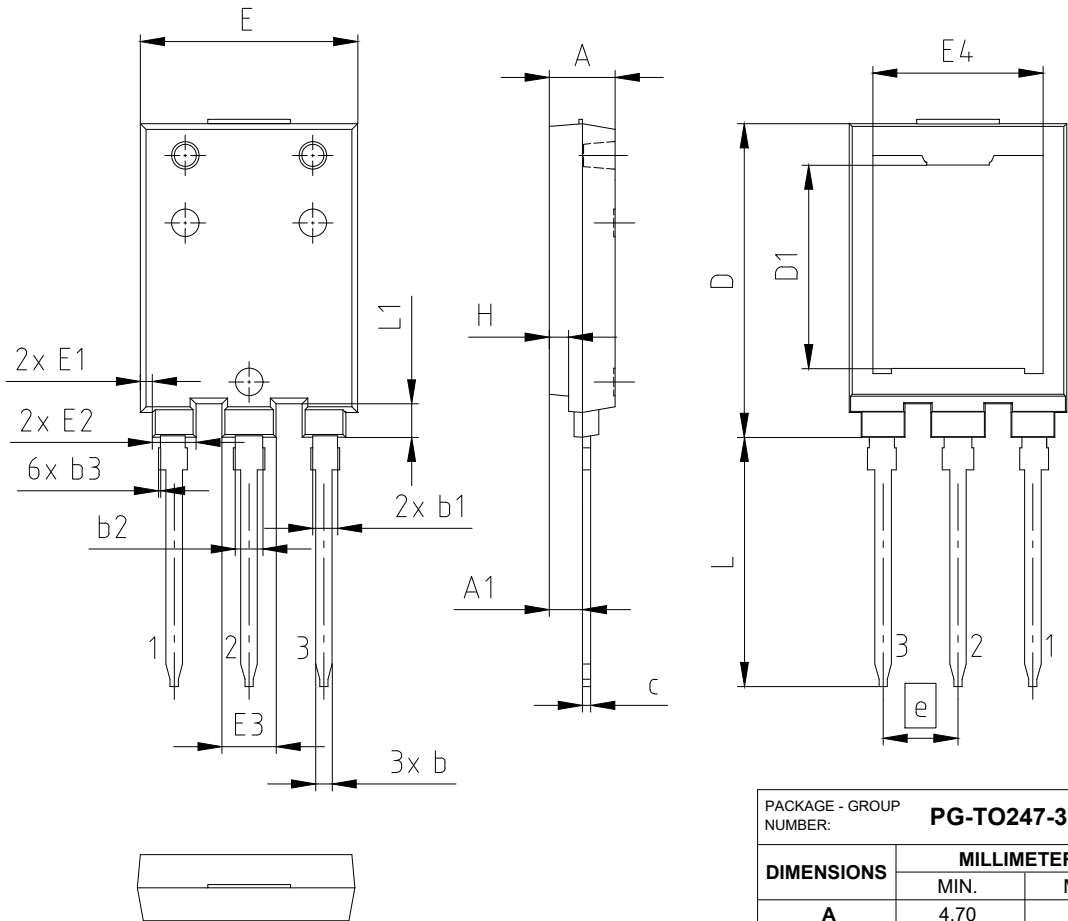
$E_{rec} = f(di_F/dt)$

$V_R = 450\text{ V}, I_F = 160\text{ A}$



5 Package outlines

PG-TO247-3-PLUS-NN8.5



PACKAGE - GROUP NUMBER:		PG-TO247-3-U02	
DIMENSIONS	MILLIMETERS		
	MIN.	MAX.	
A	4.70	4.90	
A1	2.16	2.66	
b	1.10	1.30	
b1	1.80		
b2	2.00		
b3	0.00	0.15	
c	0.50	0.70	
D	22.70	22.90	
D1	14.69	14.89	
E	15.70	15.90	
E1	0.76	0.96	
E2	3.08	3.28	
E3	3.84	4.04	
E4	12.28	12.48	
e	5.44		
N	3		
H	1.30	1.50	
L	18.01	18.21	
L1	2.34	2.54	
aaa	0.25		

NOTES:
 (1) ALL METAL SURFACES TIN PLATED EXCEPT AREA OF CUT
 (2) MOLD GATE PROTRUSION AFTER DEGATING.

Figure 1

6 Testing conditions



Figure 2

Revision history

Document revision	Date of release	Description of changes
V0.1		Target 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
1.00	2022-11-23	Final datasheet

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