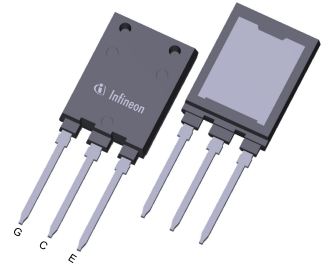


### Short circuit rugged 750 V EDT2 IGBT in reflow-solderable package co-packed with soft and fast recovery diode

#### 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  $10\text{ kHz}$
- Package backside suitable for reflow soldering at  $245^\circ\text{C}$ , 3 times
- Plating of pins further enable electrical resistance welding
- Complete product spectrum and PSpice Models: <http://www.infineon.com/igbt/>



Green



Halogen-free



RoHS

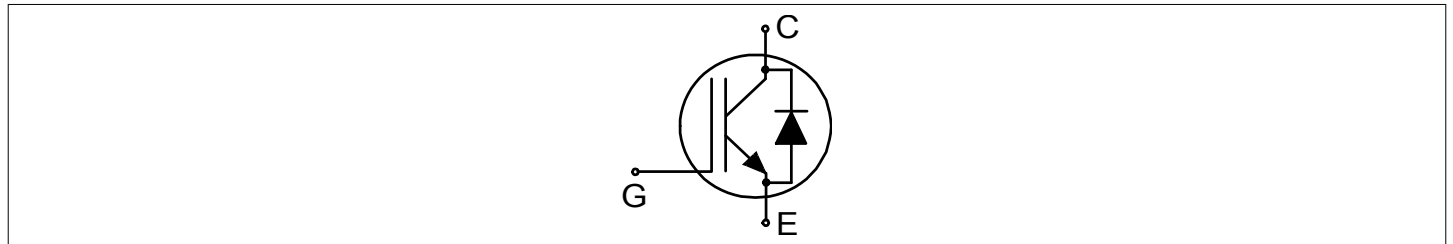
#### Potential applications

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

#### Product validation

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

#### Description



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	$V_{GE}$		$\pm 20$	V	
Transient gate-emitter voltage	$V_{GE}$	$t_p = 10\text{ }\mu\text{s}, D < 0.01$	$\pm 30$	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	$\mu\text{s}$	
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	$\mu\text{A}$
			$T_{vj} = 175\text{ °C}$		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	$Q_G$	$V_{CC} = 600\text{ V}, I_C = 160\text{ A}, V_{GE} = 15\text{ V}$			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**

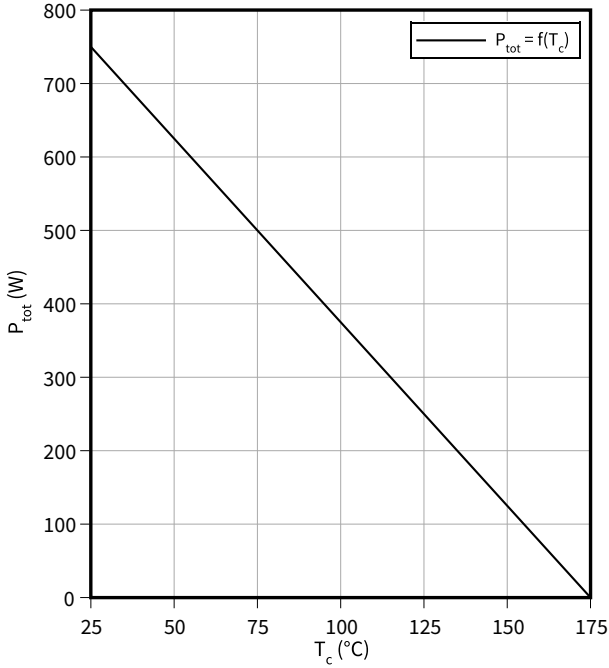
Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode reverse recovery charge	$Q_{rr}$	$V_R = 450\text{ V}$	$T_{vj} = 25\text{ °C}$ , $I_F = 160\text{ A}$ , $-di_F/dt = 1000\text{ A}/\mu\text{s}$		4.2		$\mu\text{C}$
			$T_{vj} = 175\text{ °C}$ , $I_F = 160\text{ A}$ , $-di_F/dt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

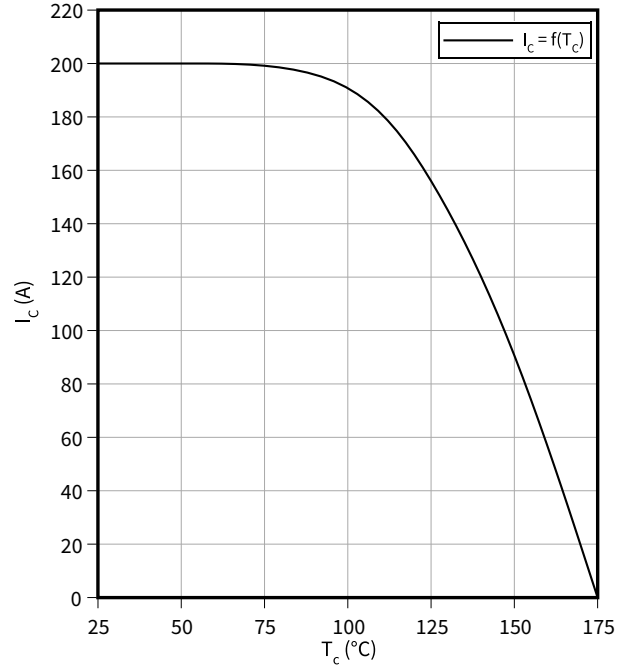
**Power dissipation as a function of case temperature**

$P_{tot} = f(T_c)$   
 $T_{vj} \leq 175\text{ }^\circ\text{C}$



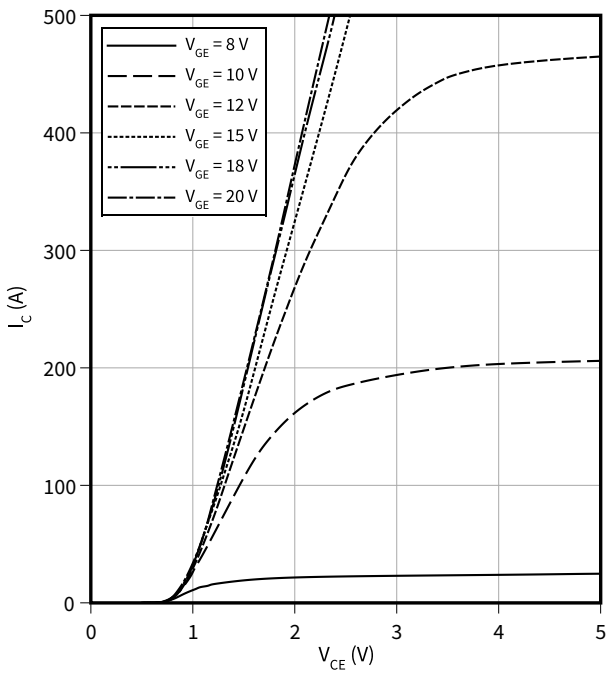
**Collector current as a function of case temperature**

$I_c = f(T_c)$   
 $T_{vj} \leq 175\text{ }^\circ\text{C}, V_{GE} \geq 15\text{ V}$



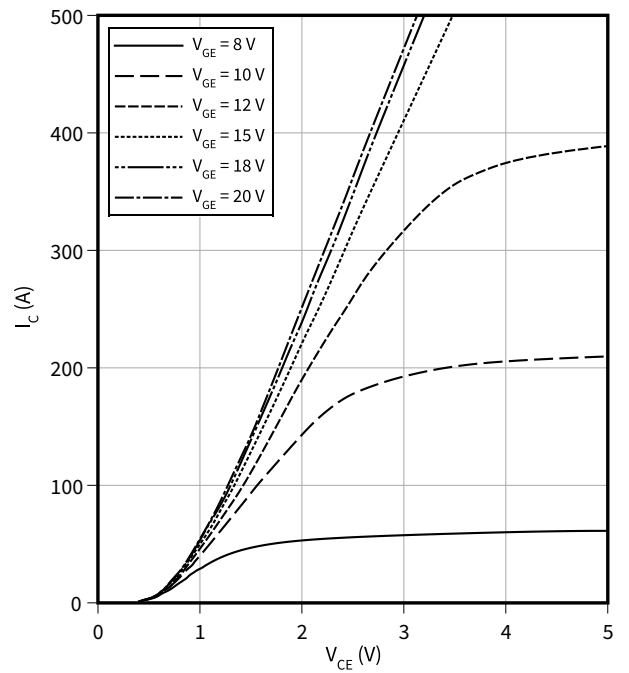
**Typical output characteristic**

$I_c = f(V_{CE})$   
 $T_{vj} = 25\text{ }^\circ\text{C}$



**Typical output characteristic**

$I_c = f(V_{CE})$   
 $T_{vj} = 175\text{ }^\circ\text{C}$

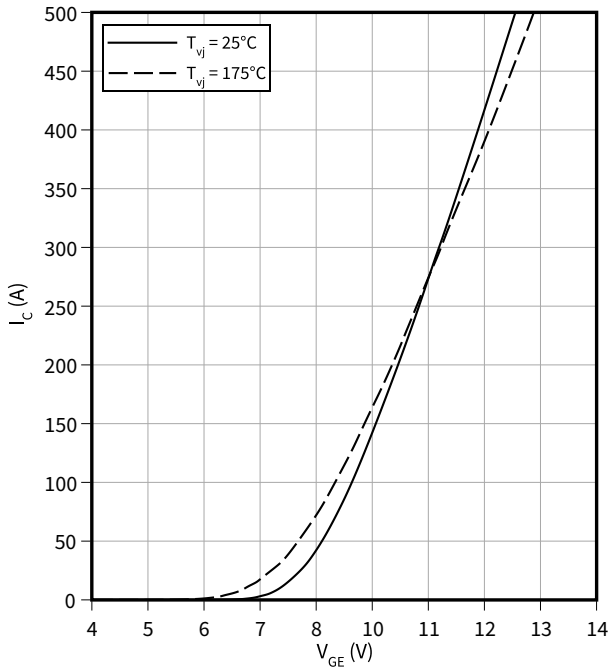


4 Characteristics diagrams

**Typical transfer characteristic**

$I_C = f(V_{GE})$

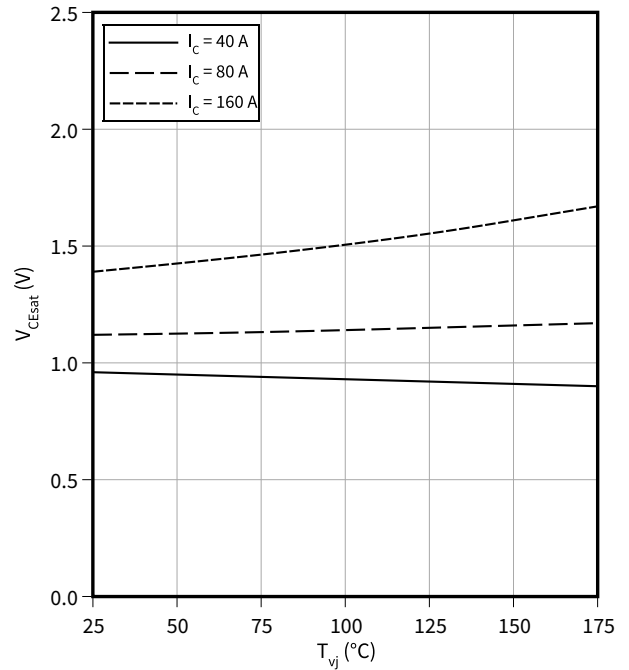
$V_{CE} = 20\text{ V}$



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

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

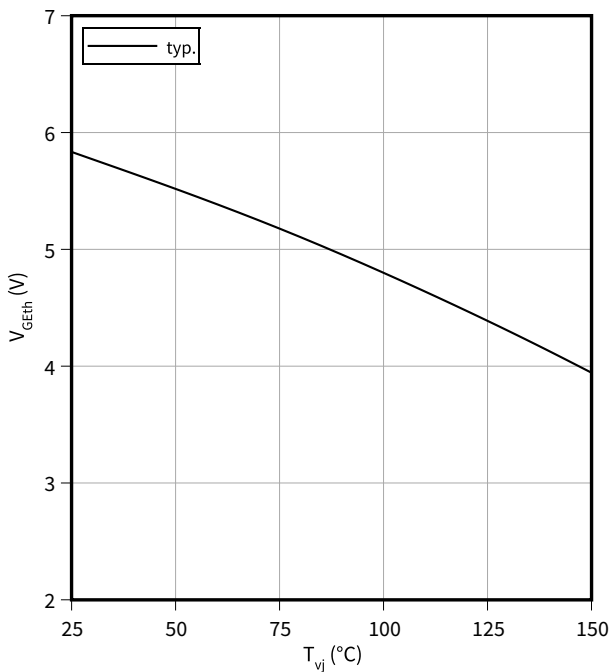
$V_{GE} = 15\text{ V}$



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

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

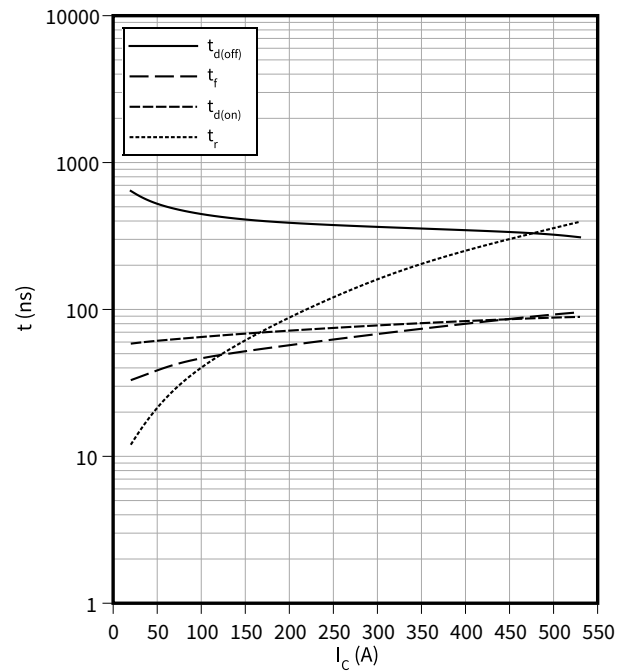
$I_C = 2.15\text{ mA}$



**Typical switching times as a function of collector current**

$t = f(I_C)$

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



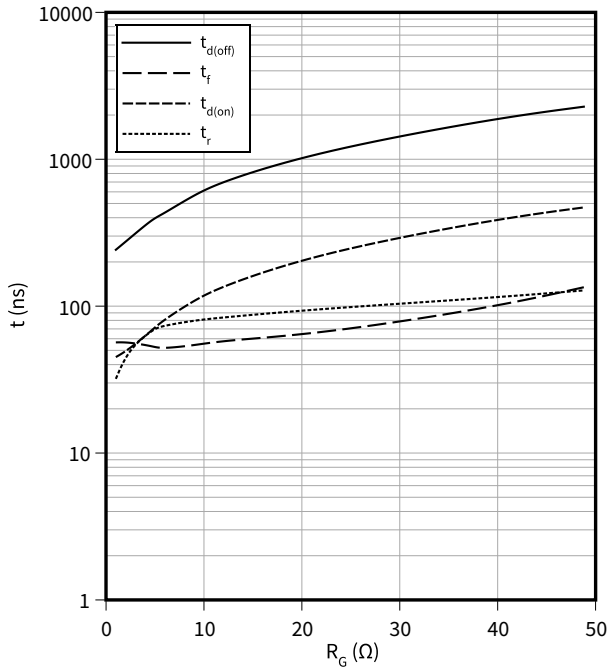


4 Characteristics diagrams

**Typical switching times as a function of gate resistor**

$t = f(R_G)$

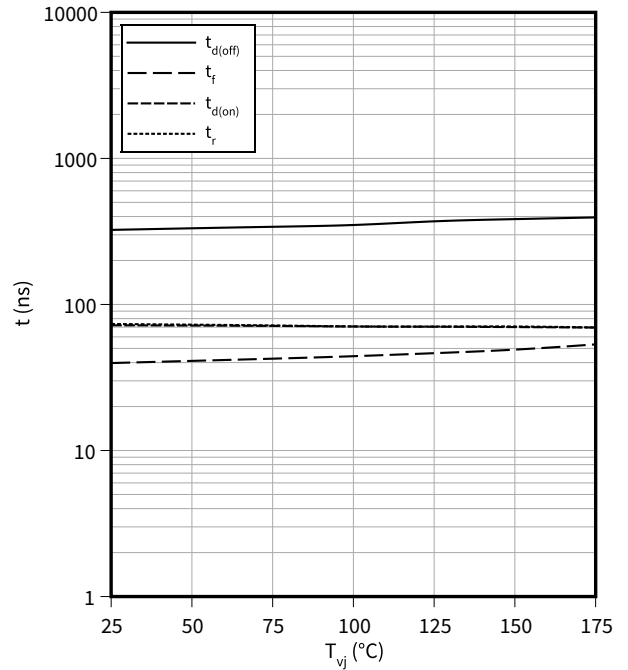
$I_C = 160 \text{ A}, V_{CC} = 450 \text{ V}, T_{vj} = 175 \text{ }^\circ\text{C}, V_{GE} = 0/15 \text{ V}$



**Typical switching times as a function of junction temperature**

$t = f(T_{vj})$

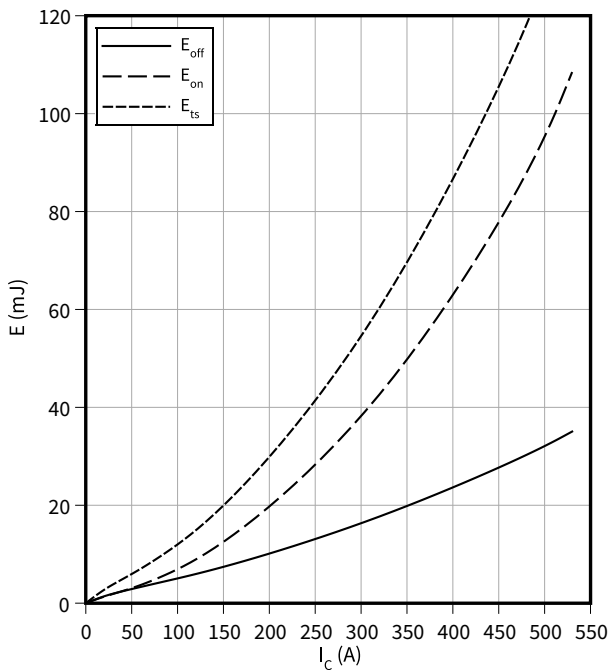
$I_C = 160 \text{ A}, V_{CC} = 450 \text{ V}, V_{GE} = 0/15 \text{ V}, R_G = 4.8 \text{ } \Omega$



**Typical switching energy losses as a function of collector current**

$E = f(I_C)$

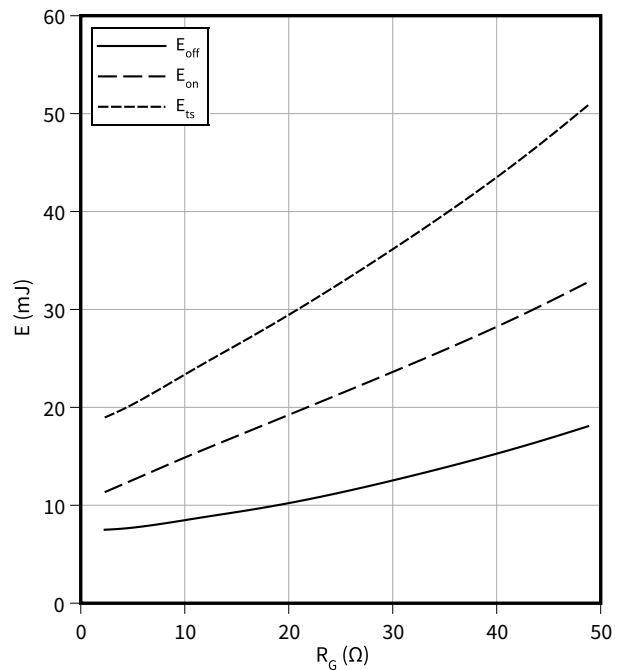
$V_{CC} = 450 \text{ V}, T_{vj} = 175 \text{ }^\circ\text{C}, V_{GE} = 0/15 \text{ V}, R_G = 4.8 \text{ } \Omega$



**Typical switching energy losses as a function of gate resistor**

$E = f(R_G)$

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

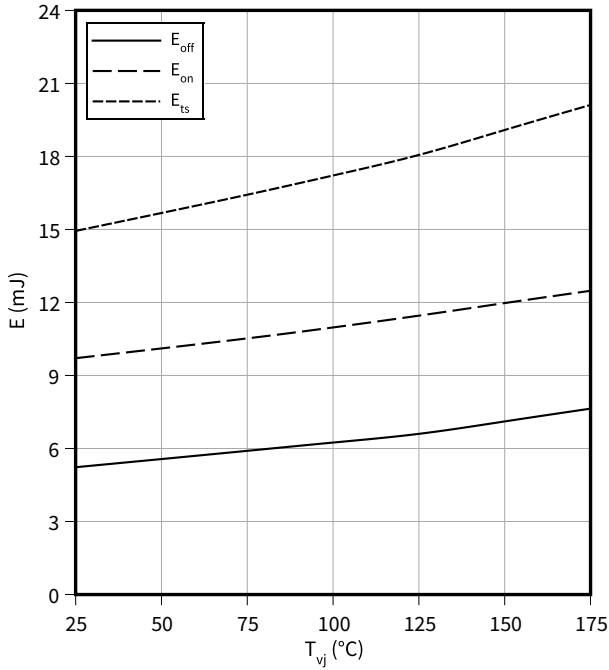


4 Characteristics diagrams

**Typical switching energy losses as a function of junction temperature**

$E = f(T_{vj})$

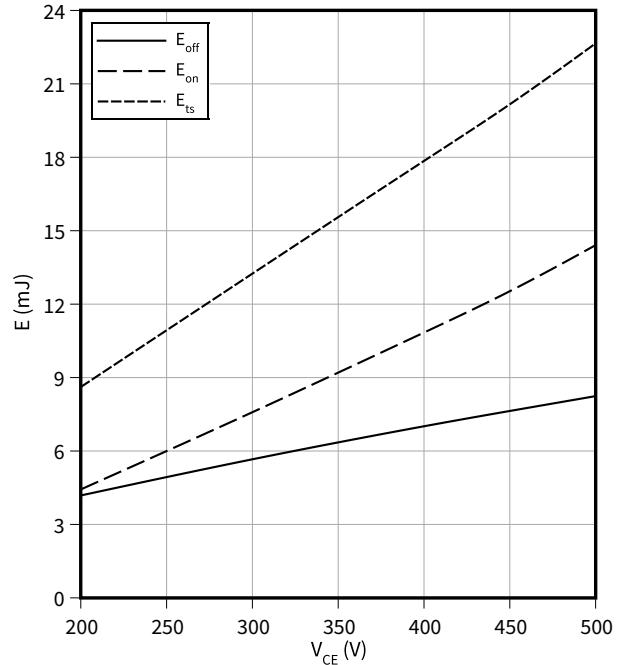
$I_C = 160 \text{ A}, V_{CC} = 450 \text{ V}, V_{GE} = 0/15 \text{ V}, R_G = 4.8 \Omega$



**Typical switching energy losses as a function of collector emitter voltage**

$E = f(V_{CE})$

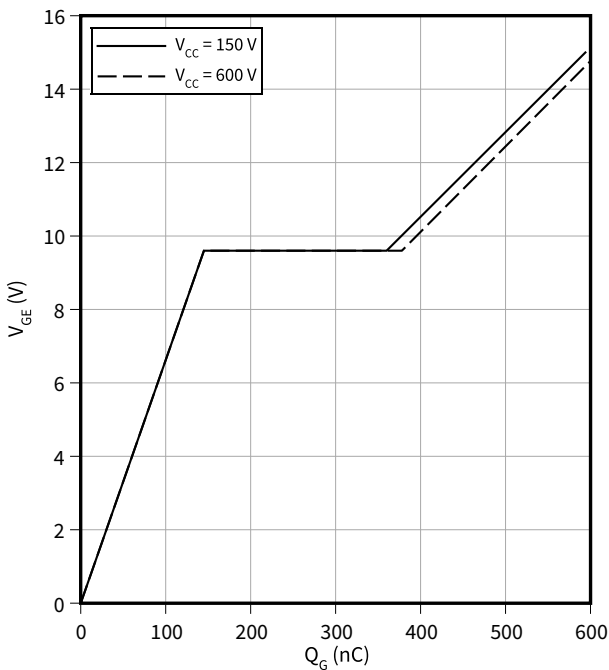
$I_C = 160 \text{ A}, V_{GE} = 0/15 \text{ V}, T_{vj} = 175 \text{ °C}, R_G = 4.8 \Omega$



**Typical gate charge**

$V_{GE} = f(Q_G)$

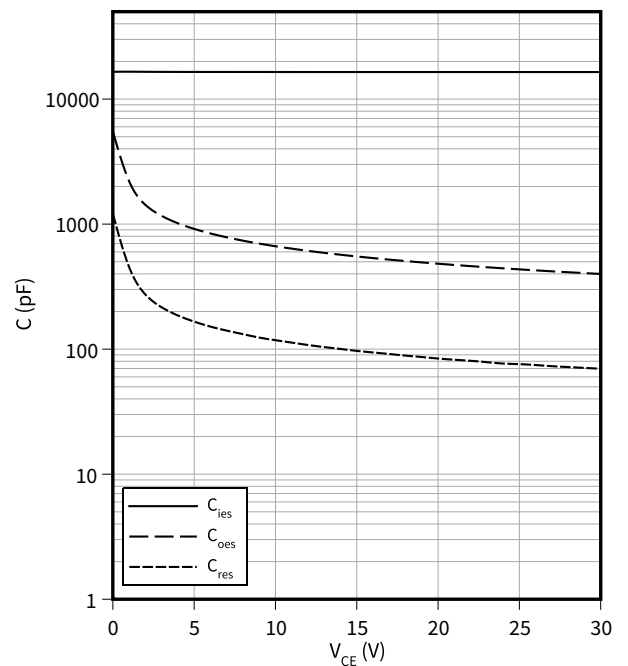
$I_C = 160 \text{ A}$



**Typical capacitance as a function of collector-emitter voltage**

$C = f(V_{CE})$

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

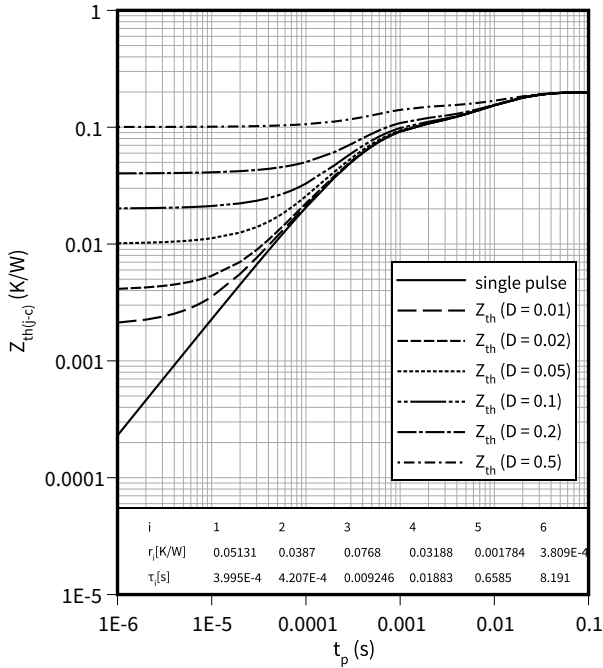


4 Characteristics diagrams

**IGBT transient thermal impedance as a function of pulse width**

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

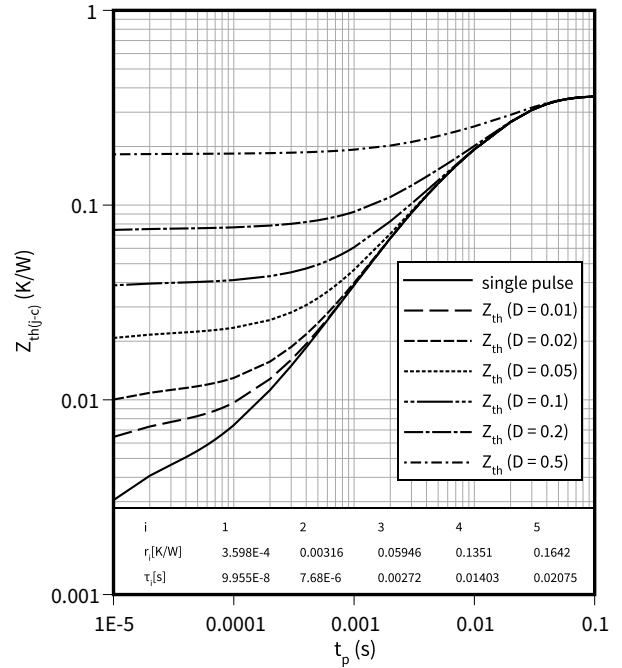
$$D = t_p/T$$



**Diode transient thermal impedance as a function of pulse width**

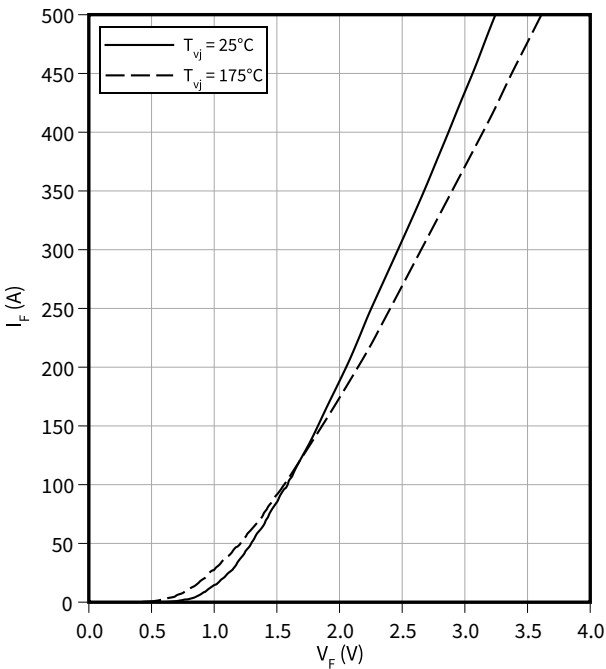
$$Z_{th(j-c)} = f(t_p)$$

$$D = t_p/T$$



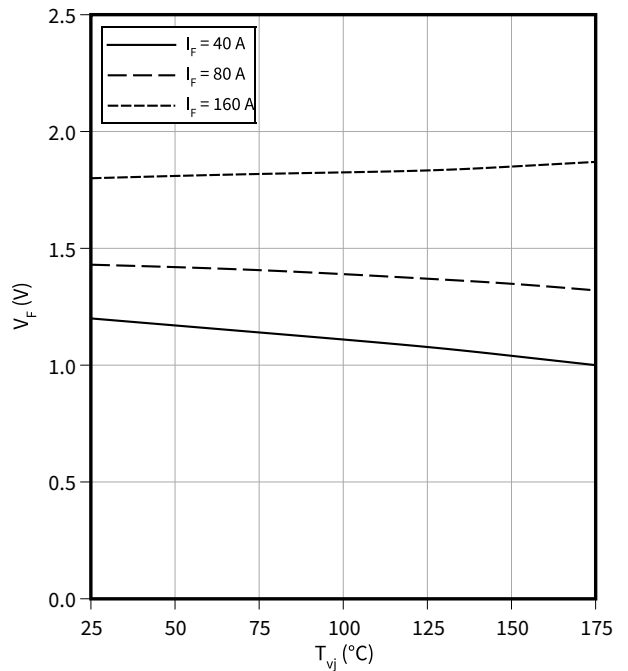
**Typical diode forward current as a function of forward voltage**

$$I_F = f(V_F)$$



**Typical diode forward voltage as a function of junction temperature**

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

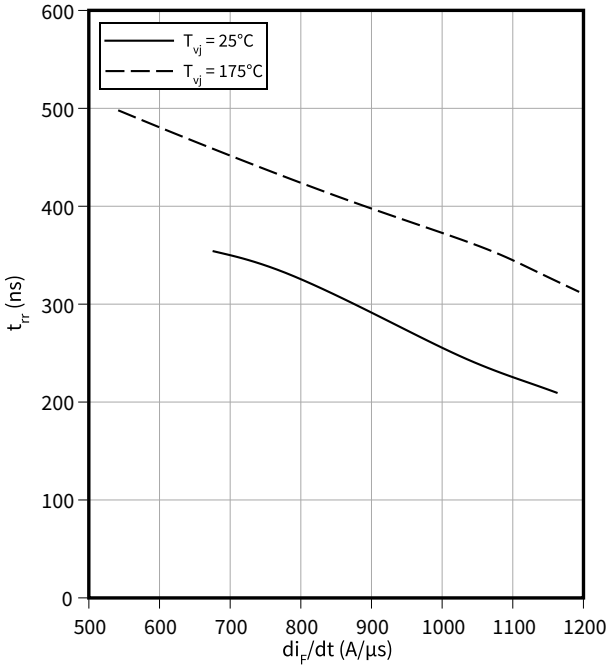


4 Characteristics diagrams

**Typical reverse recovery time as a function of diode current slope**

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

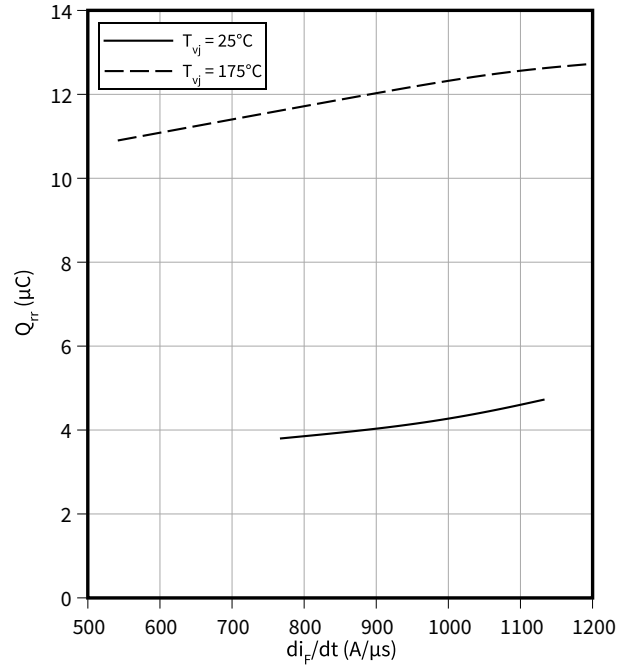
$V_R = 450 \text{ V}, I_F = 160 \text{ A}$



**Typical reverse recovery charge as a function of diode current slope**

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

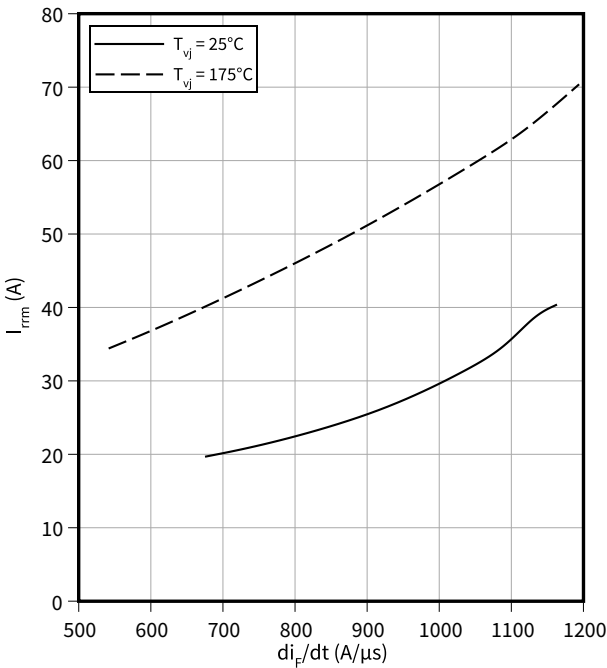
$V_R = 450 \text{ V}, I_F = 160 \text{ A}$



**Typical reverse recovery current as a function of diode current slope**

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

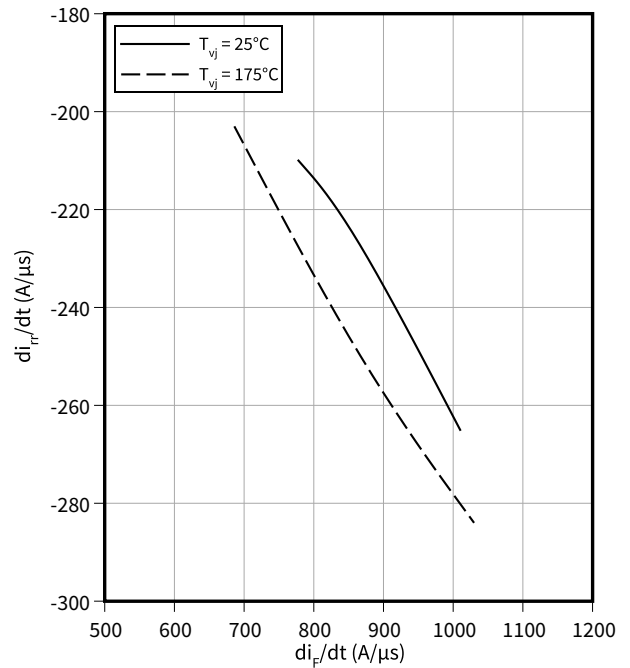
$V_R = 450 \text{ V}, I_F = 160 \text{ A}$



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

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

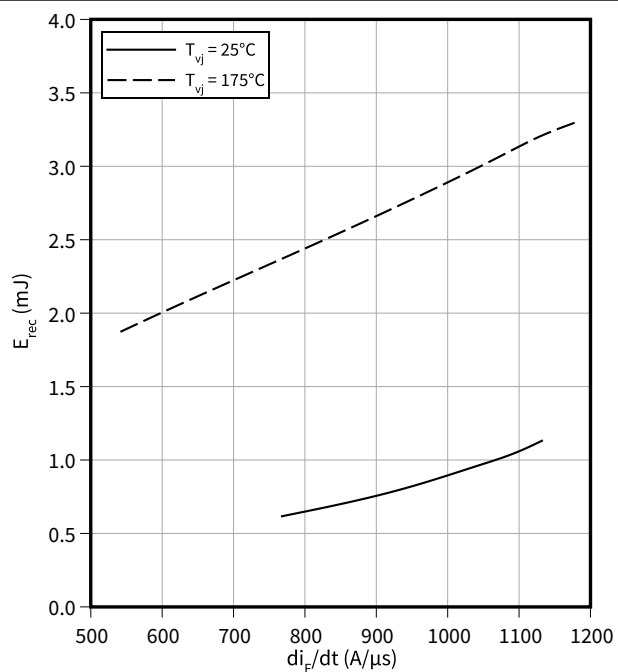
$V_R = 450 \text{ V}, I_F = 160 \text{ A}$



**Typical reverse energy losses as a function of diode current slope**

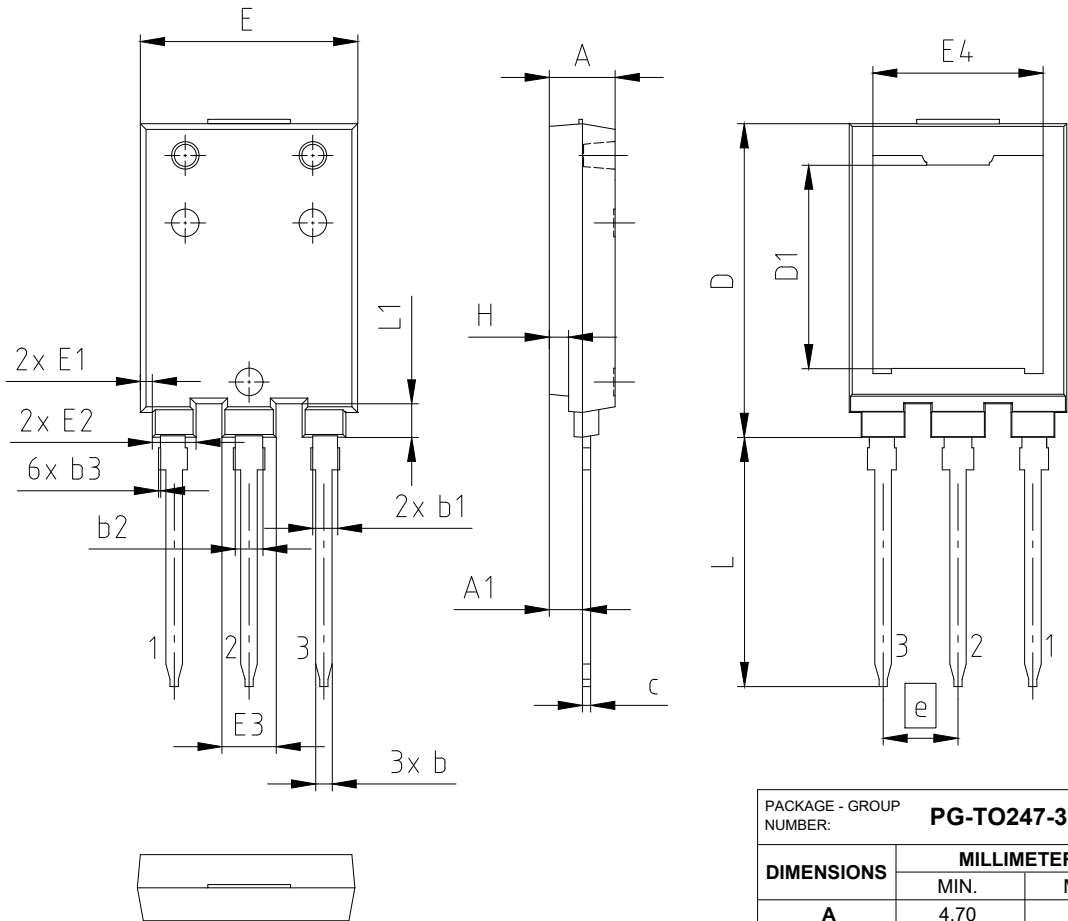
$E_{rec} = f(di_F/dt)$

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



**5 Package outlines**

**PG-TO247-3-PLUS-NN8.5**



PACKAGE - GROUP NUMBER:		<b>PG-TO247-3-U02</b>	
DIMENSIONS	MILLIMETERS		
	MIN.	MAX.	
<b>A</b>	4.70	4.90	
<b>A1</b>	2.16	2.66	
<b>b</b>	1.10	1.30	
<b>b1</b>	1.80		
<b>b2</b>	2.00		
<b>b3</b>	0.00	0.15	
<b>c</b>	0.50	0.70	
<b>D</b>	22.70	22.90	
<b>D1</b>	14.69	14.89	
<b>E</b>	15.70	15.90	
<b>E1</b>	0.76	0.96	
<b>E2</b>	3.08	3.28	
<b>E3</b>	3.84	4.04	
<b>E4</b>	12.28	12.48	
<b>e</b>	5.44		
<b>N</b>	3		
<b>H</b>	1.30	1.50	
<b>L</b>	18.01	18.21	
<b>L1</b>	2.34	2.54	
<b>aaa</b>	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
1.10	2023-06-30	Editorial changes on cover page



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