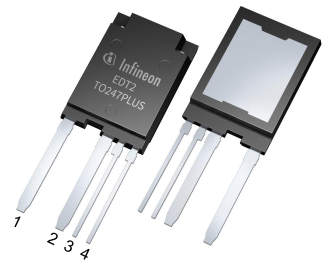


## Final datasheet

### Duo Pack EDT2™ IGBT and emitter controlled diode in TO247PLUS package

#### Features

- $V_{CE} = 750\text{ V}$
- $I_C = 160\text{ A}$
- Suitable for 470 V  $V_{DC}$  systems and increased overvoltage margin for 400 V  $V_{DC}$  systems
- Very low  $V_{CEsat}$  (C-KE) = 1.22 V (typ.) at  $I_{Cnom} = 160\text{ A}$ , 25°C
- Up to 40% less System  $R_{th}$  due to reflow capability, increased power output
- 30% Less Turn On Energy loss compared to 3 pin devices due to Kelvin emitter
- Short circuit robust  $t_{sc} = 3\text{ }\mu\text{s}$  at  $V_{CE} = 470\text{ V}$ ,  $V_{GE} = 15\text{ V}$
- Self limiting current under short circuit condition
- Positive thermal coefficient and very tight parameter distribution for easy paralleling
- Excellent current sharing in parallel operation
- Smooth switching characteristics
- Low gate charge  $Q_G$
- Simple gate driver design
- Co-packed with fast soft recovery emitter controlled diode (Emcon3)
- Low EMI signature
- TO247PLUS package with high creepage distance 6.6 mm
- High reliability and operating lifetime, proven power cycling sec. robustness
- Wide Power pins (2 mm) for high current busbar
- Resistive weldable pins for direct busbar connections
- Lead-free plated pins and back



#### Potential applications

- xEV traction inverter
- DC-link discharge switch
- Automotive aux-drives

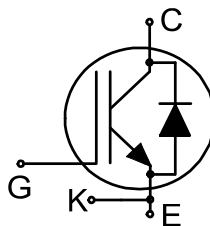
#### Product validation

- Qualified according to AEC-Q101 for automotive applications
- Qualified Reflow device 260°C according to JEDEC J-STD-020 MSL2

#### Description

Package pin definition:

- Pin C (1) & backside - collector
- Pin E (2) - emitter
- Pin K (3) - Kelvin emitter
- Pin G (4) - gate



Type	Package	Marking
AIKYX160N75CP2	PG-TO247-4-PLUS-WT7	AKYX16FCP

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## 1 Package

**Table 1** Characteristic values

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 <sup>1)</sup>	K/W
Diode thermal resistance, junction-case	$R_{th(j-c)}$			0.28	0.36 <sup>1)</sup>	K/W

1) Defined by simulation, not subject to production test

## 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 $T_{vjmax}$	$I_C$		$T_c = 25\text{ °C}$	200	A
			$T_c = 100\text{ °C}$	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 <sup>1)</sup>	$t_{SC}$	$V_{CC} \leq 470\text{ V}, V_{GE} = -8/15\text{ V}$ , Allowed number of short circuits < 1000, Time between short circuits $\geq 1.0\text{ s}, T_{vj} = 25\text{ °C}$	3	μs	
Power dissipation	$P_{tot}$	$T_{vj} = 175\text{ °C}$	$T_c = 25\text{ °C}$	750	W
			$T_c = 100\text{ °C}$	375	

1) Measured with kelvin emitter for driving

**Table 3** Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CEsat}$	$I_C = 160\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25\text{ °C}$	1.2	1.37	1.55	V
			$T_{vj} = 175\text{ °C}$		1.6		
Collector-Kelvin emitter saturation voltage	$V_{CEsat}$ (C-KE)	$I_C = 160\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25\text{ °C}$		1.22		V
Gate-emitter threshold voltage	$V_{GEth}$	$I_C = 2.15\text{ mA}, V_{CE} = V_{GE}$		5.2	5.8	6.4	V
Zero gate-voltage collector current	$I_{CES}$	$V_{CE} = 750\text{ V}, V_{GE} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$			200	$\mu\text{A}$
			$T_{vj} = 175\text{ °C}$		8		mA
Gate-emitter leakage current	$I_{GES}$	$V_{CE} = 0\text{ V}, V_{GE} = 20\text{ V}$				100	nA
Transconductance	$g_{fs}$	$I_C = 160\text{ A}, V_{CE} = 20\text{ V}$			117		S
Short-circuit collector current	$I_{SC}$	$V_{CC} \leq 470\text{ V}, V_{GE} = -8/15\text{ V}, t_{SC} \leq 3\text{ }\mu\text{s}$ , Allowed number of short circuits < 1000, Time between short circuits $\geq 1.0\text{ s}$ , $T_{vj} = 25\text{ °C}$			1500		A
Input capacitance	$C_{ies}$	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$			17280		pF
Output capacitance	$C_{oes}$	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$			443		pF
Reverse transfer capacitance	$C_{res}$	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$			79		pF
Gate charge	$Q_G$	$V_{CC} = 600\text{ V}, I_C = 160\text{ A}, V_{GE} = -8/15\text{ V}$			975		nC
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 470\text{ V}, V_{GE} = -8/15\text{ V}, R_{G(on)} = 5\text{ }\Omega, L_\sigma = 20\text{ nH}, C_\sigma = 15\text{ pF}$	$T_{vj} = 25\text{ °C}, I_C = 160\text{ A}$		64		ns
			$T_{vj} = 175\text{ °C}, I_C = 160\text{ A}$		64		
Rise time (inductive load)	$t_r$	$V_{CC} = 470\text{ V}, V_{GE} = -8/15\text{ V}, R_{G(on)} = 5\text{ }\Omega, L_\sigma = 20\text{ nH}, C_\sigma = 15\text{ pF}$	$T_{vj} = 25\text{ °C}, I_C = 160\text{ A}$		35		ns
			$T_{vj} = 175\text{ °C}, I_C = 160\text{ A}$		43		
Turn-off delay time	$t_{d(off)}$	$V_{CC} = 470\text{ V}, V_{GE} = -8/15\text{ V}, R_{G(on)} = 5\text{ }\Omega, L_\sigma = 20\text{ nH}, C_\sigma = 15\text{ pF}$	$T_{vj} = 25\text{ °C}, I_C = 160\text{ A}$		234		ns
			$T_{vj} = 175\text{ °C}, I_C = 160\text{ A}$		315		
Fall time (inductive load)	$t_f$	$V_{CC} = 470\text{ V}, V_{GE} = -8/15\text{ V}, R_{G(on)} = 5\text{ }\Omega, L_\sigma = 20\text{ nH}, C_\sigma = 15\text{ pF}$	$T_{vj} = 25\text{ °C}, I_C = 160\text{ A}$		57		ns
			$T_{vj} = 175\text{ °C}, I_C = 160\text{ A}$		121		

(table continues...)

**Table 3 (continued) Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit	
			Min.	Typ.	Max.		
Turn-on energy <sup>1)</sup>	$E_{on}$	$V_{CC} = 470\text{ V}, V_{GE} = -8/15\text{ V}, R_{G(on)} = 5\ \Omega, L_{\sigma} = 20\text{ nH}, C_{\sigma} = 15\text{ pF}$	$T_{vj} = 25\text{ }^{\circ}\text{C}, I_C = 160\text{ A}$		5.5		mJ
			$T_{vj} = 175\text{ }^{\circ}\text{C}, I_C = 160\text{ A}$		7.7		
Turn-off energy	$E_{off}$	$V_{CC} = 470\text{ V}, V_{GE} = -8/15\text{ V}, R_{G(on)} = 5\ \Omega, L_{\sigma} = 20\text{ nH}, C_{\sigma} = 15\text{ pF}$	$T_{vj} = 25\text{ }^{\circ}\text{C}, I_C = 160\text{ A}$		4.9		mJ
			$T_{vj} = 175\text{ }^{\circ}\text{C}, I_C = 160\text{ A}$		8.8		
Total switching energy	$E_{ts}$	$V_{CC} = 470\text{ V}, V_{GE} = -8/15\text{ V}, R_{G(on)} = 5\ \Omega, L_{\sigma} = 20\text{ nH}, C_{\sigma} = 15\text{ pF}$	$T_{vj} = 25\text{ }^{\circ}\text{C}, I_C = 160\text{ A}$		10.4		mJ
			$T_{vj} = 175\text{ }^{\circ}\text{C}, I_C = 160\text{ A}$		16.5		
Operating junction temperature	$T_{vj}$		-40		175	$^{\circ}\text{C}$	

1) includes IGBT losses caused by the reverse recovery current

**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	$V_{RRM}$	$T_{vj} \geq 25\text{ }^{\circ}\text{C}$	750	V	
Diode forward current, limited by $T_{vjmax}$	$I_F$		$T_C = 25\text{ }^{\circ}\text{C}$	200	A
			$T_C = 100\text{ }^{\circ}\text{C}$	160	
Diode pulsed current, $t_p$ limited by $T_{vjmax}$	$I_{Fpulse}$		480	A	
Power dissipation	$P_{tot}$	$T_{vj} = 175\text{ }^{\circ}\text{C}$	$T_C = 25\text{ }^{\circ}\text{C}$	417	W
			$T_C = 100\text{ }^{\circ}\text{C}$	208	

**Table 5 Characteristic values**

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

(table continues...)

**Table 5 (continued) Characteristic values**

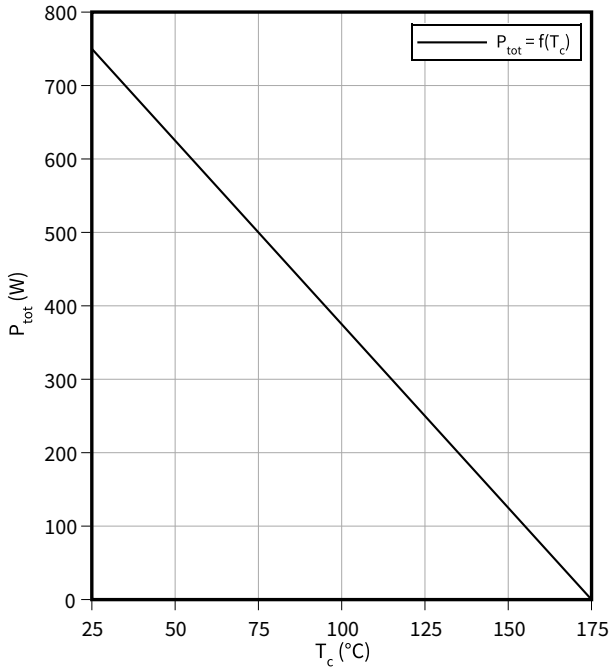
Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode reverse recovery charge	$Q_{rr}$	$V_R = 470\text{ V}$	$T_{vj} = 25\text{ °C},$ $I_F = 160\text{ A},$ $-di_F/dt = 3996\text{ A}/\mu\text{s}$		5.5		$\mu\text{C}$
					14		
Diode peak reverse recovery current	$I_{rrm}$	$V_R = 470\text{ V}$	$T_{vj} = 25\text{ °C},$ $I_F = 160\text{ A},$ $-di_F/dt = 3996\text{ A}/\mu\text{s}$		68.7		A
					108.1		
Reverse recovery energy	$E_{rec}$	$V_R = 470\text{ V}, L_\sigma = 20\text{ nH},$ $C_\sigma = 15\text{ pF}$	$T_{vj} = 25\text{ °C},$ $I_F = 160\text{ A},$ $-di_F/dt = 3996\text{ A}/\mu\text{s}$		2.1		mJ
					4.9		
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

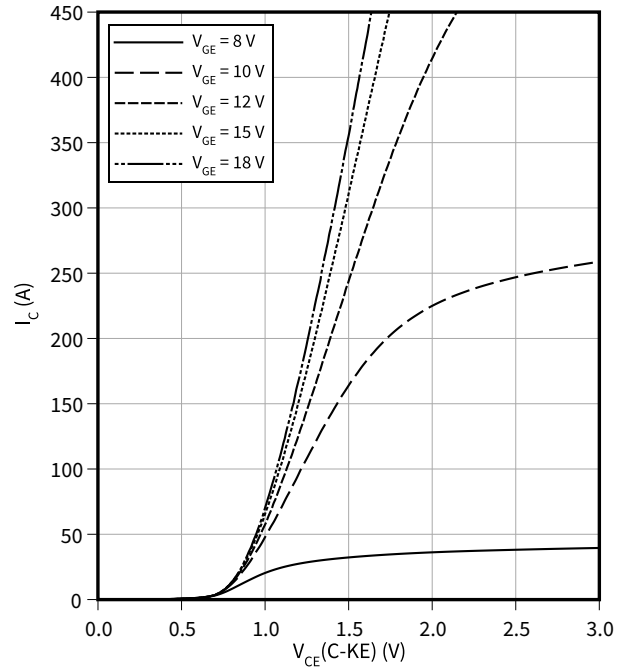
### Power dissipation as a function of case temperature

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



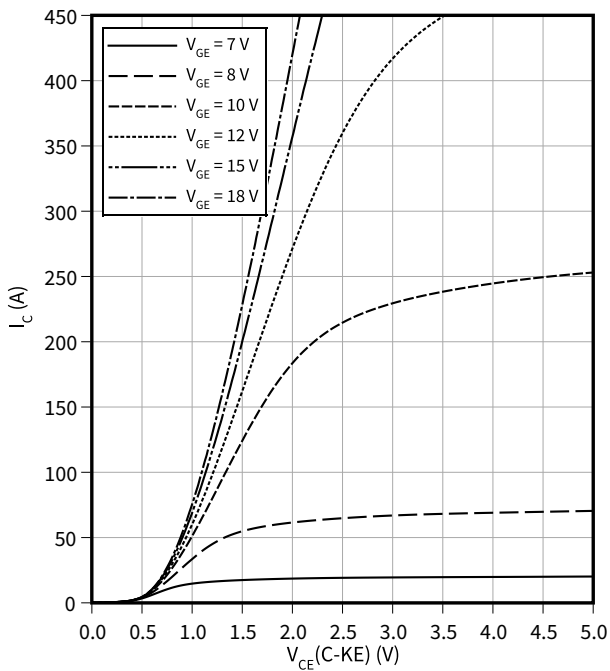
### Typical output characteristic

$I_C = f(V_{CE}(C-KE))$   
 $T_{vj} = 25\text{ °C}$



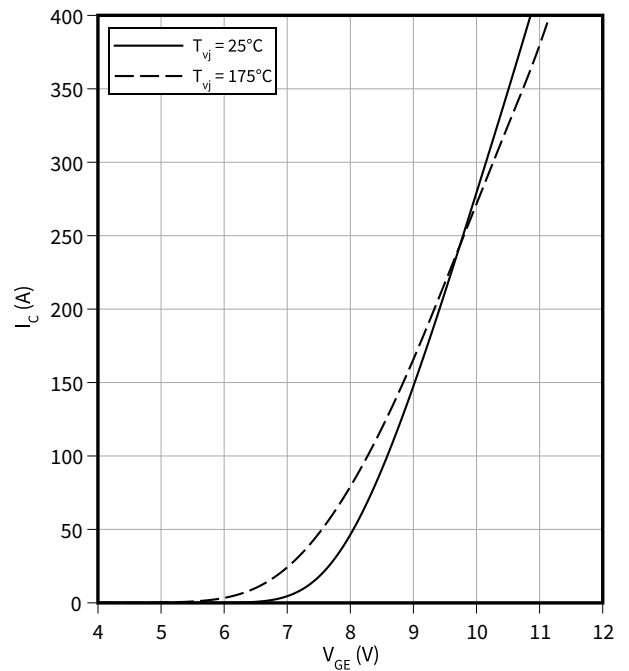
### Typical output characteristic

$I_C = f(V_{CE}(C-KE))$   
 $T_{vj} = 175\text{ °C}$



### Typical transfer characteristic

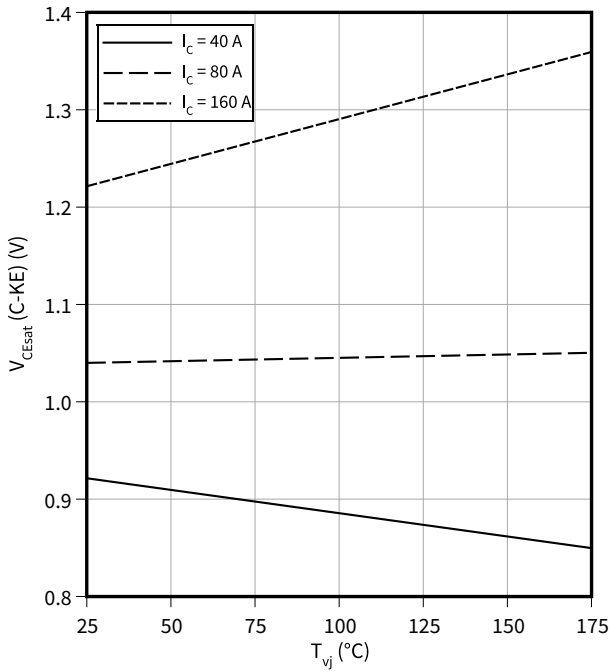
$I_C = f(V_{GE})$   
 $V_{CE} = 20\text{ V}$



4 Characteristics diagrams

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

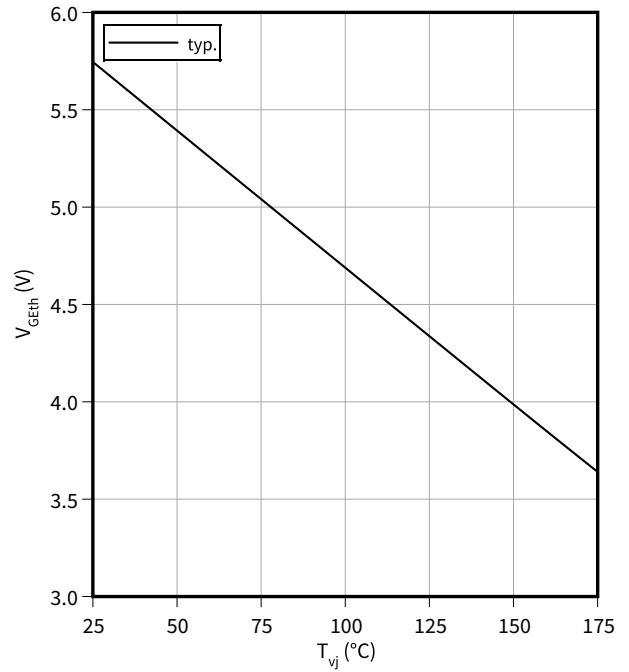
$V_{CEsat} (C-KE) = f(T_{vj})$



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

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

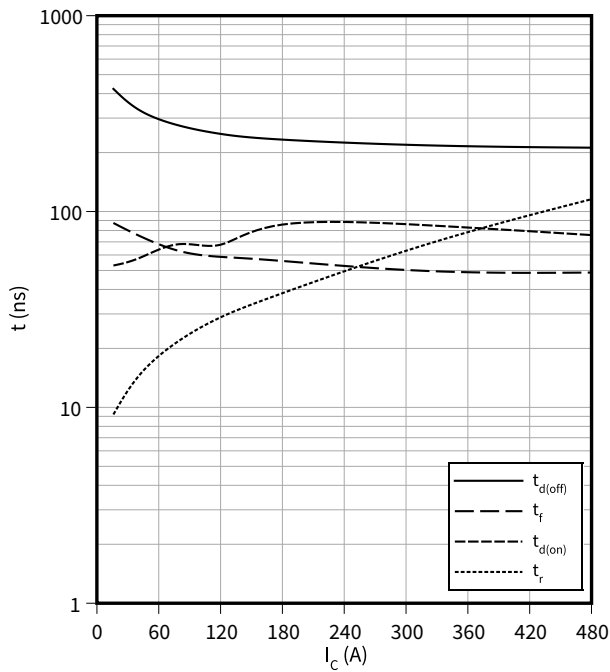
$I_c = 2.15$  mA



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

$t = f(I_c)$

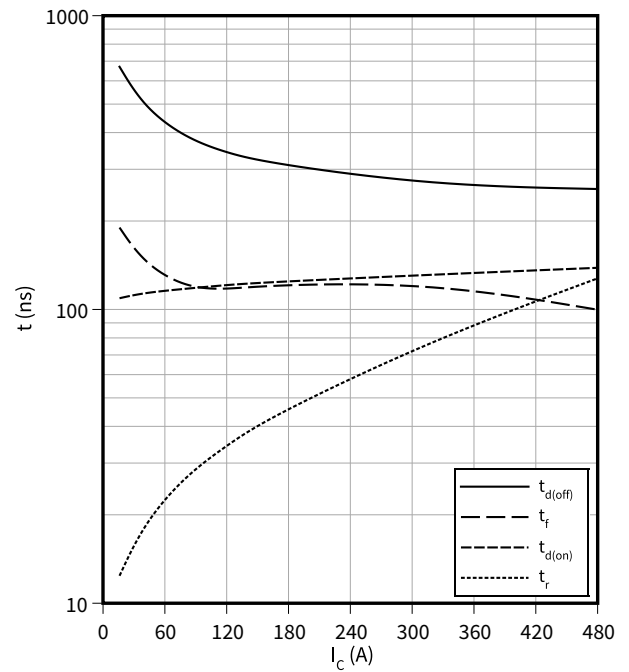
$V_{CC} = 470$  V,  $T_{vj} = 25$  °C,  $R_G = 5$   $\Omega$



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

$t = f(I_c)$

$V_{CC} = 470$  V,  $T_{vj} = 175$  °C,  $R_G = 5$   $\Omega$



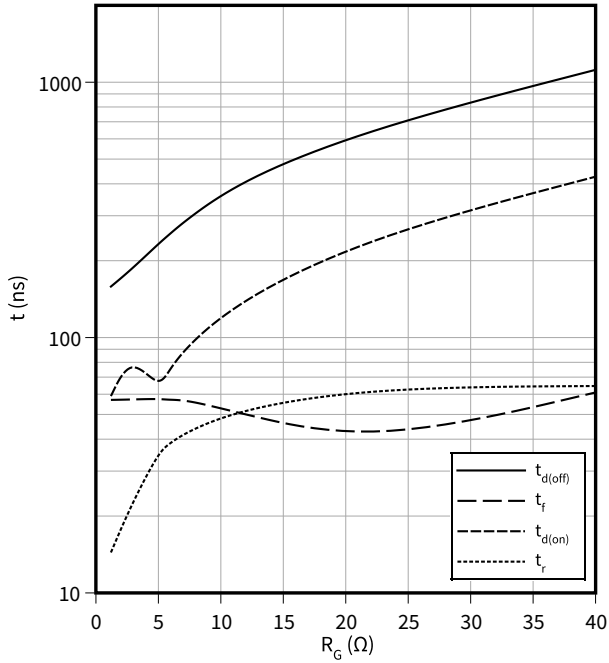


**4 Characteristics diagrams**

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

$t = f(R_G)$

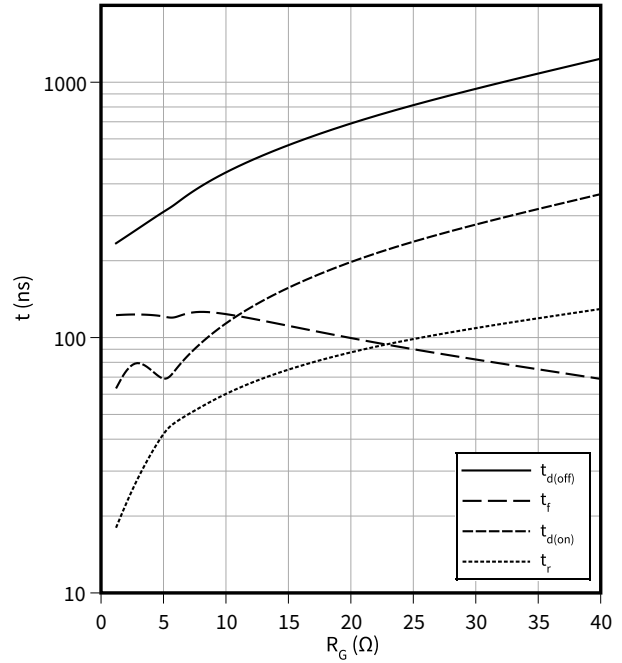
$I_C = 160 \text{ A}, V_{CC} = 470 \text{ V}, T_{vj} = 25 \text{ °C}$



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

$t = f(R_G)$

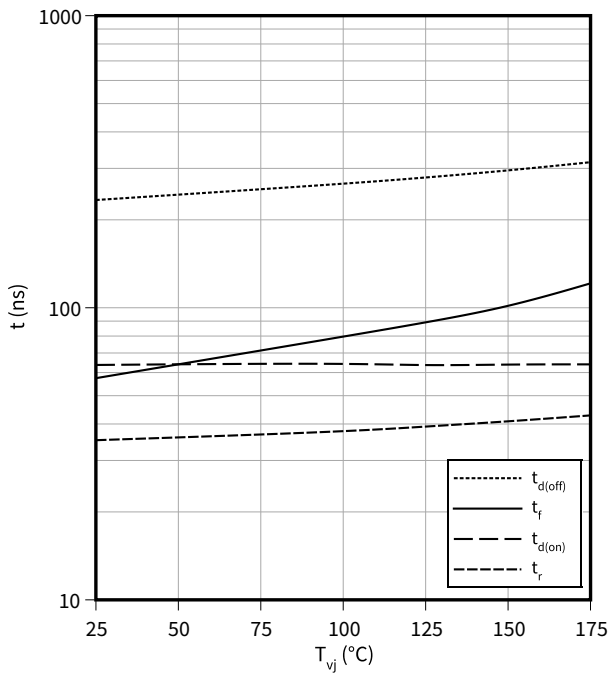
$I_C = 160 \text{ A}, V_{CC} = 470 \text{ V}, T_{vj} = 175 \text{ °C}$



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

$t = f(T_{vj})$

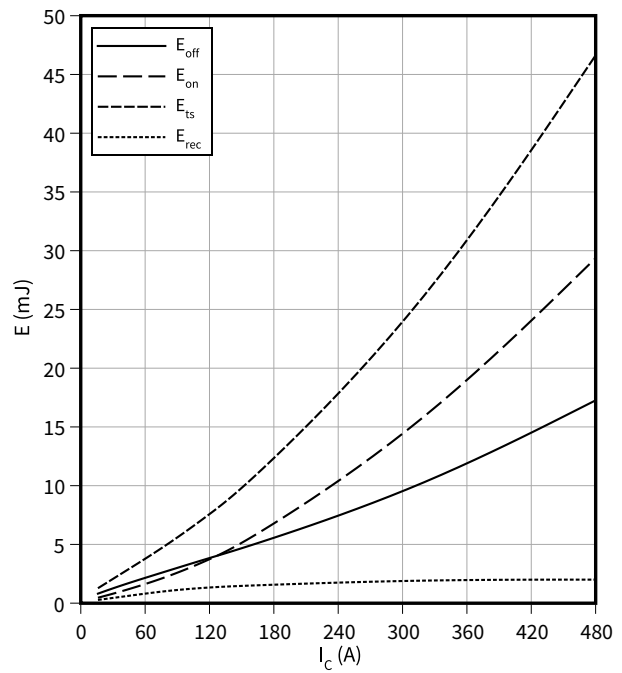
$I_C = 160 \text{ A}, V_{CC} = 470 \text{ V}, R_G = 5 \text{ Ω}$



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

$E = f(I_C)$

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

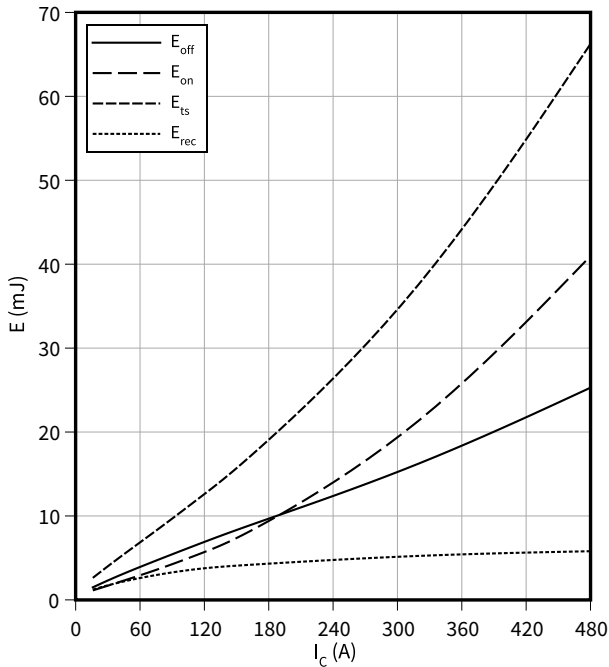


4 Characteristics diagrams

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

$E = f(I_C)$

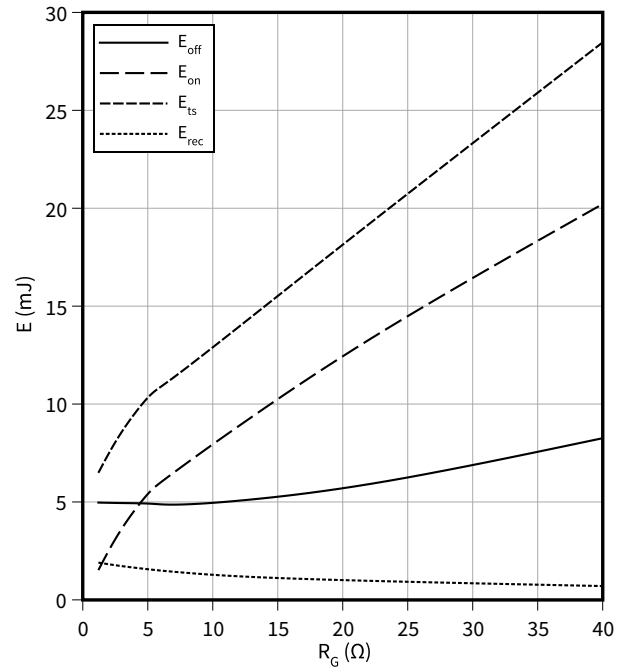
$V_{CC} = 470\text{ V}$ ,  $T_{vj} \geq 25\text{ °C}$ ,  $R_G = 5\ \Omega$



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

$E = f(R_G)$

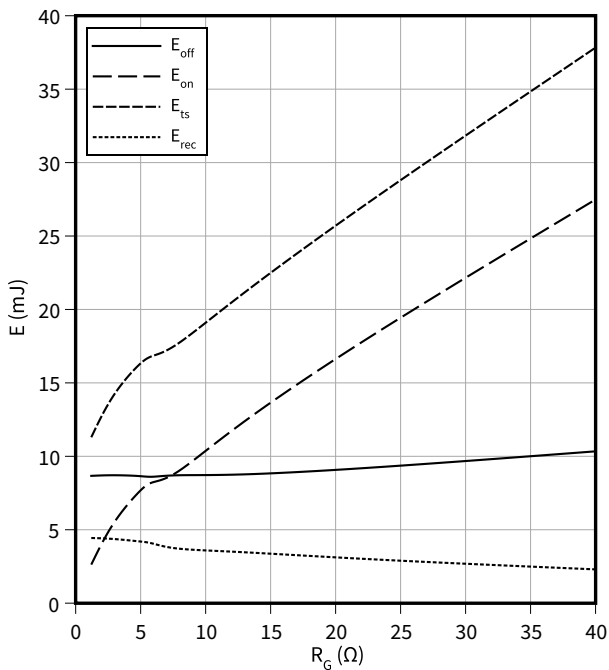
$I_C = 160\text{ A}$ ,  $V_{CC} = 470\text{ V}$ ,  $T_{vj} = 25\text{ °C}$



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

$E = f(R_G)$

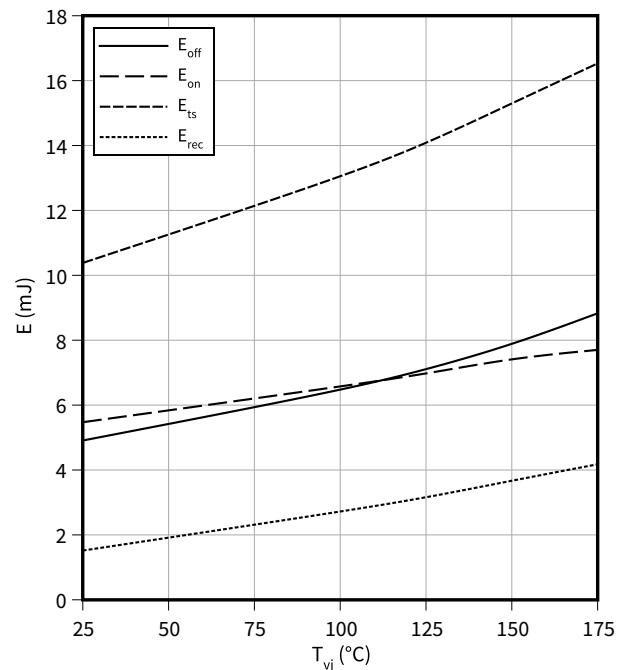
$I_C = 160\text{ A}$ ,  $V_{CC} = 470\text{ V}$ ,  $T_{vj} = 175\text{ °C}$



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

$E = f(T_{vj})$

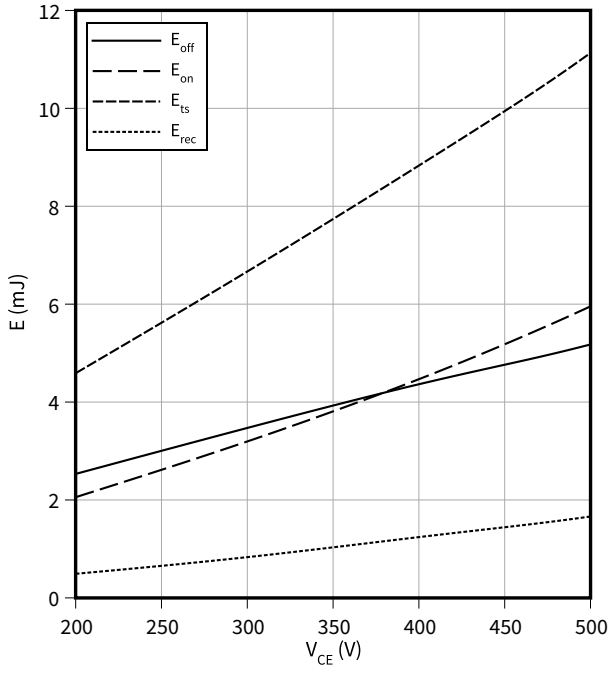
$I_C = 160\text{ A}$ ,  $V_{CC} = 470\text{ V}$ ,  $R_G = 5\ \Omega$



**4 Characteristics diagrams**

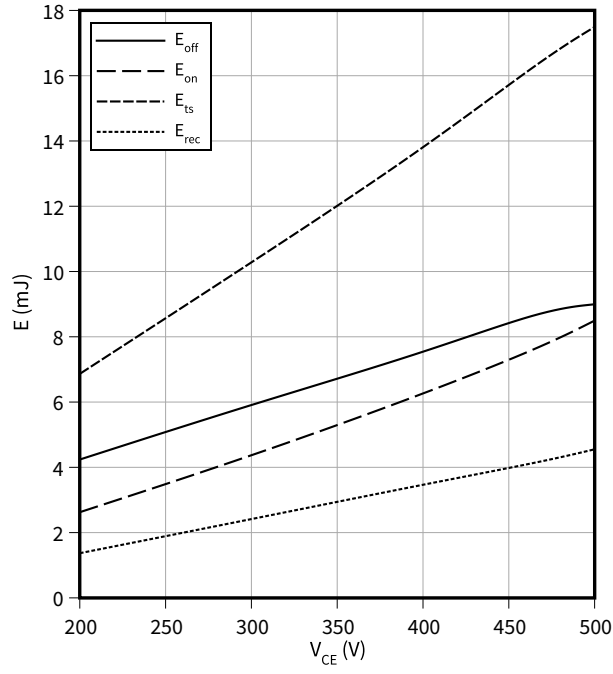
**Typical switching energy losses as a function of collector emitter voltage**

$E = f(V_{CE})$   
 $I_C = 160 \text{ A}, T_{vj} = 25 \text{ °C}, R_G = 5 \text{ }\Omega$



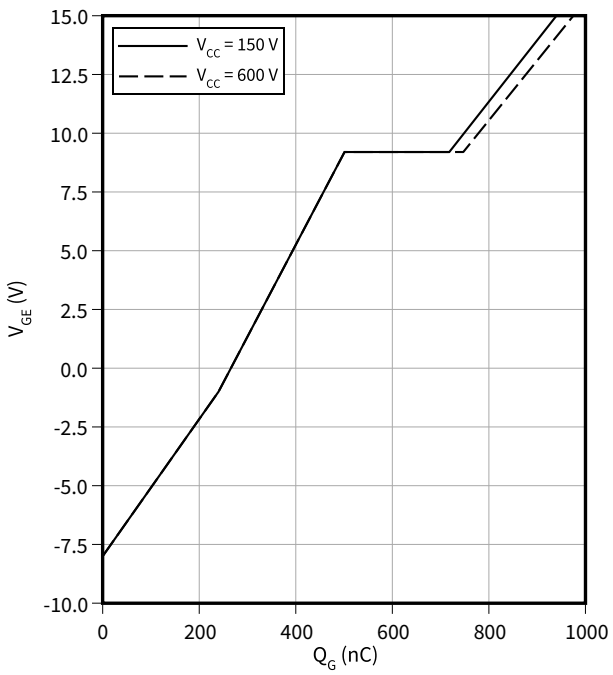
**Typical switching energy losses as a function of collector emitter voltage**

$E = f(V_{CE})$   
 $I_C = 160 \text{ A}, T_{vj} = 175 \text{ °C}, R_G = 5 \text{ }\Omega$



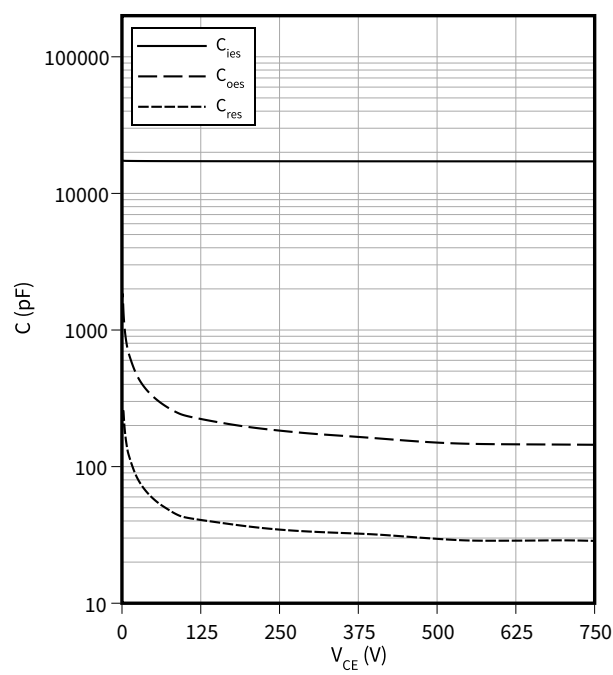
**Typical gate charge**

$V_{GE} = f(Q_G)$   
 $I_C = 160 \text{ A}$



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

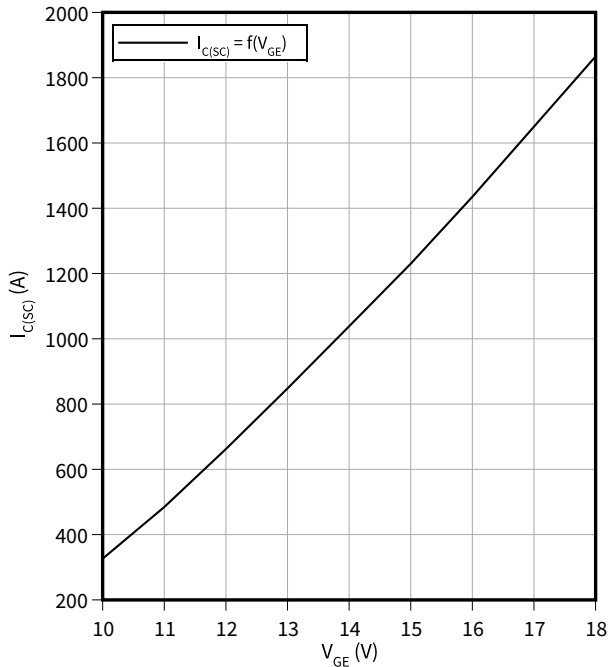
$C = f(V_{CE})$   
 $f = 100 \text{ kHz}$



**4 Characteristics diagrams**

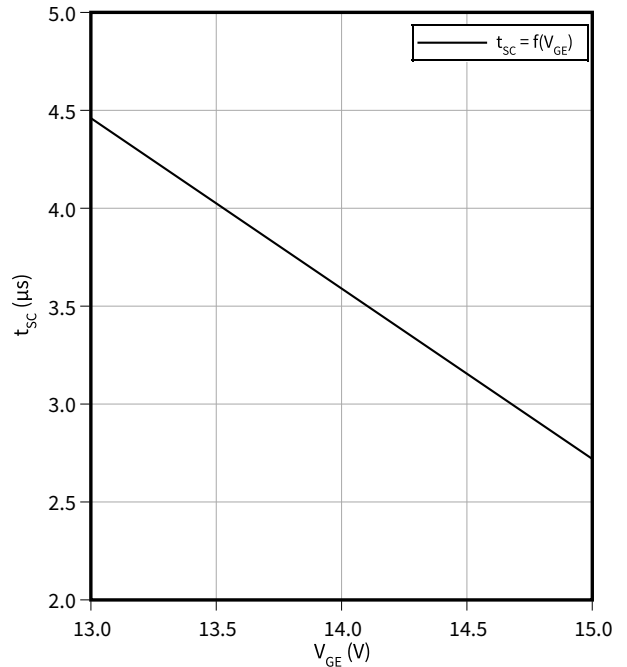
**Typical short circuit collector current as a function of gate-emitter voltage**

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



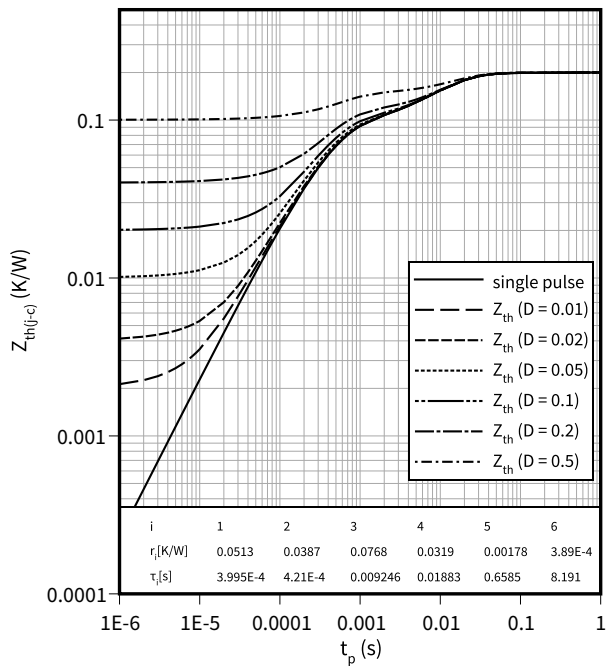
**Short circuit withstand time as a function of gate-emitter voltage**

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



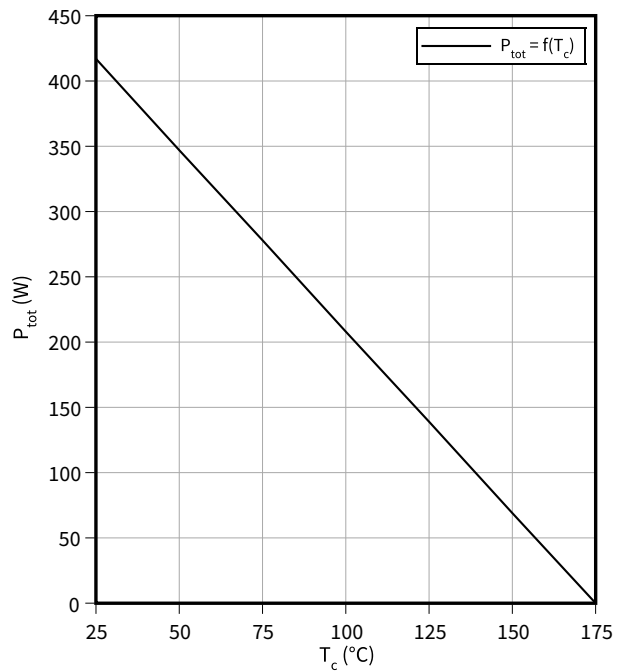
**IGBT transient thermal impedance as a function of pulse width**

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



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

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

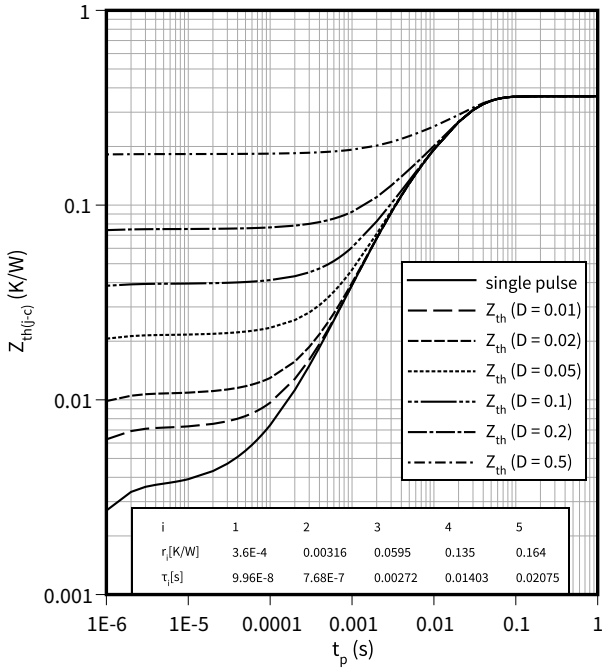


**4 Characteristics diagrams**

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

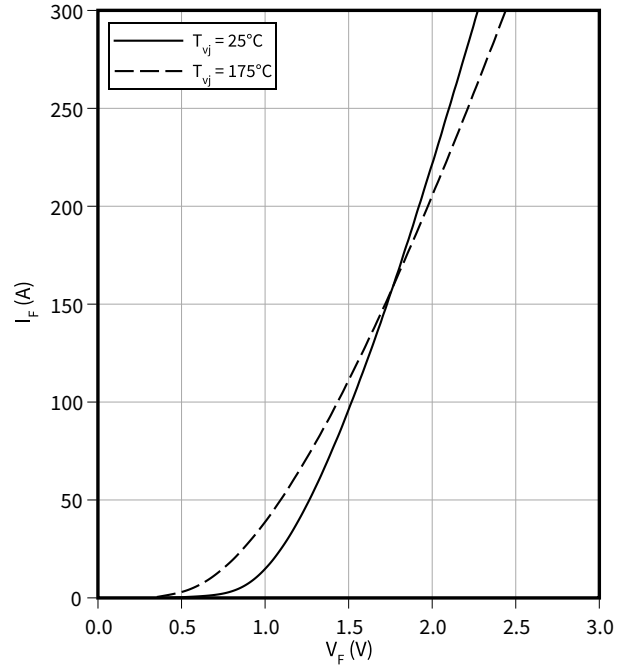
$$Z_{th(j-c)} = f(t_p)$$

$$D = t_p/T$$



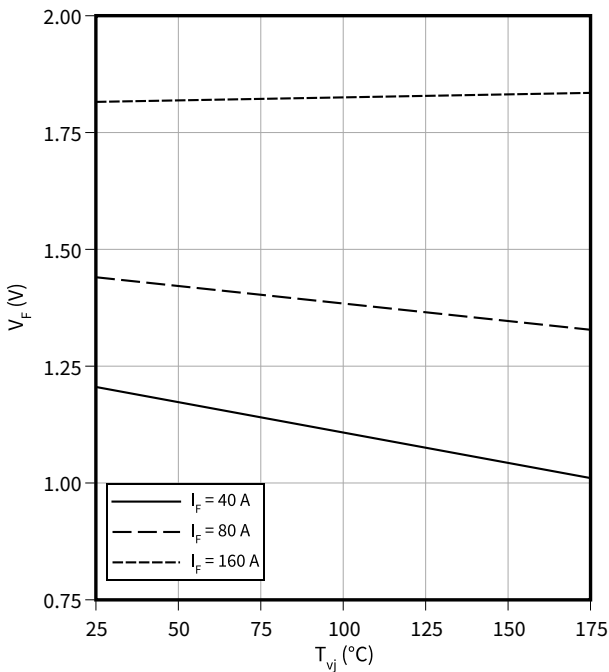
**Typical diode forward current as a function of forward voltage**

$$I_F = f(V_F)$$



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

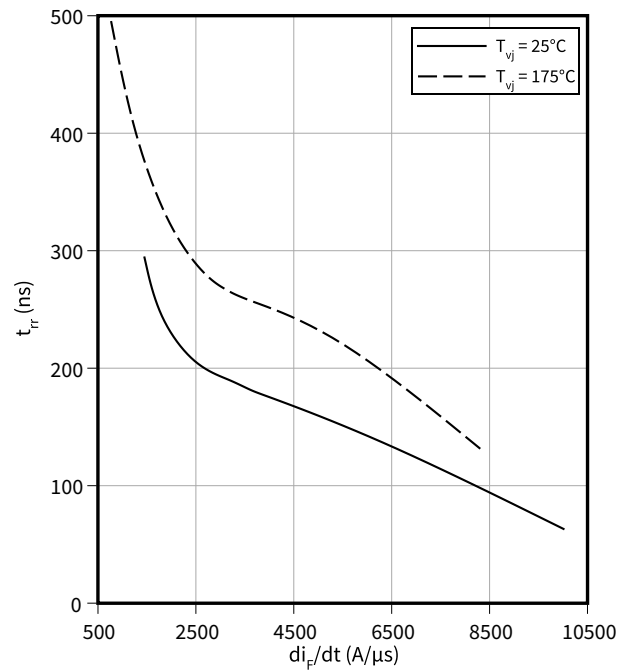
$$V_F = f(T_{vj})$$



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

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

$$V_R = 470 \text{ V}, I_F = 160 \text{ A}$$

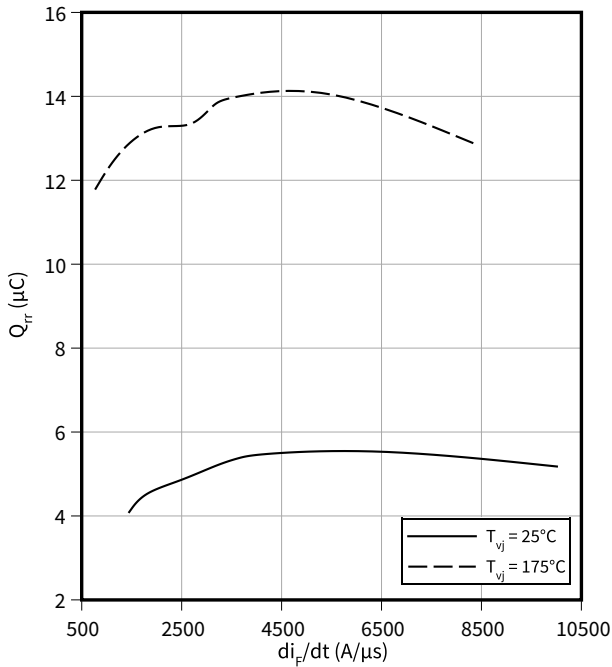


4 Characteristics diagrams

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

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

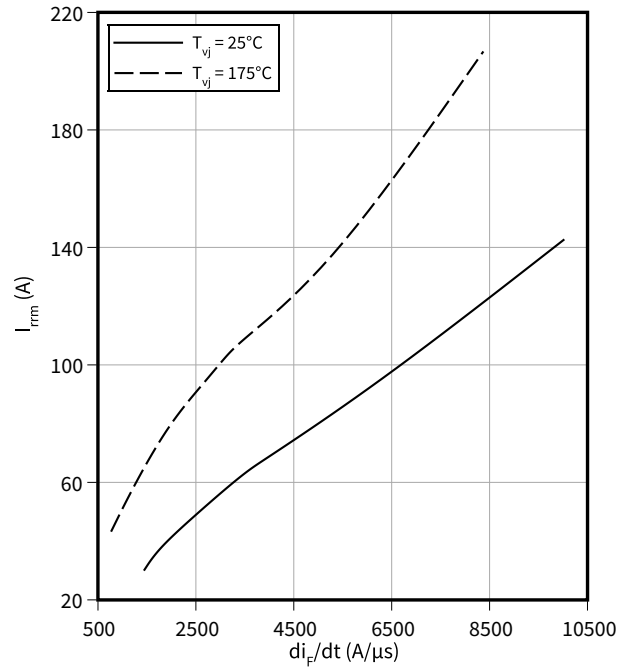
$V_R = 470 \text{ V}, I_F = 160 \text{ A}$



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

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

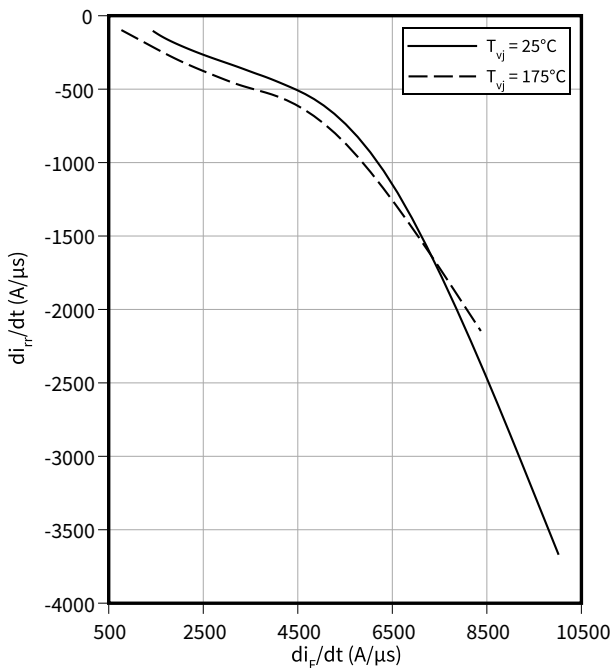
$V_R = 470 \text{ V}, I_F = 160 \text{ A}$



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

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

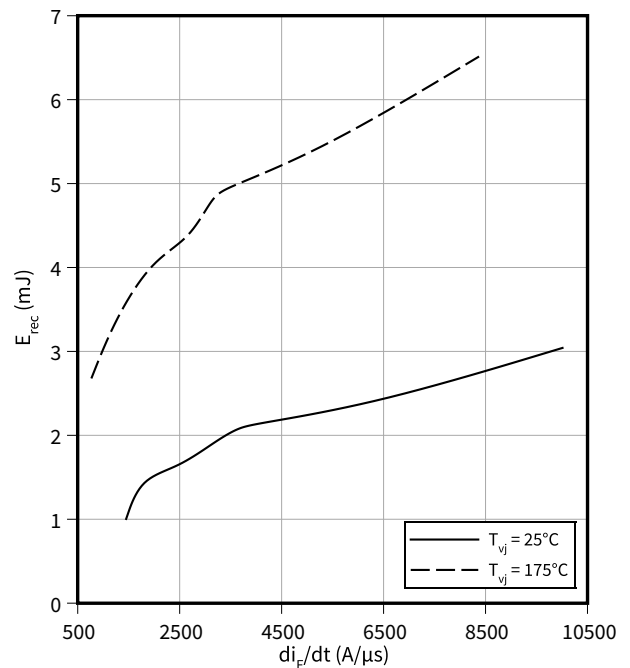
$V_R = 470 \text{ V}, I_F = 160 \text{ A}$



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

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

$V_R = 470 \text{ V}, I_F = 160 \text{ A}$

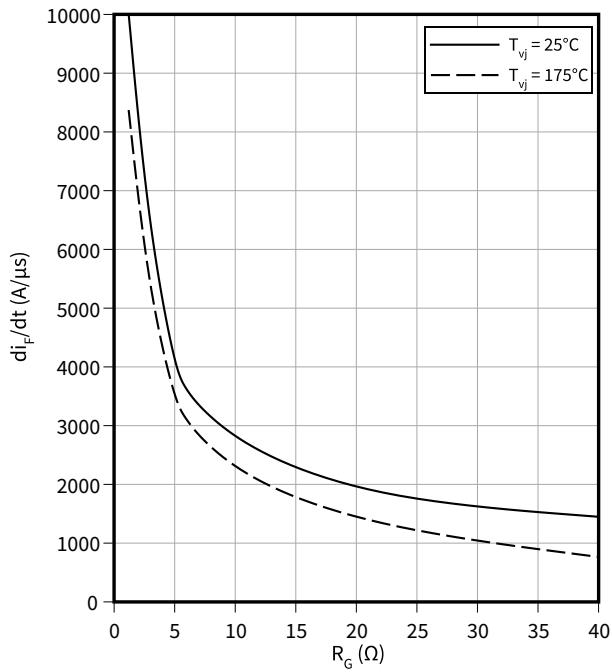


4 Characteristics diagrams

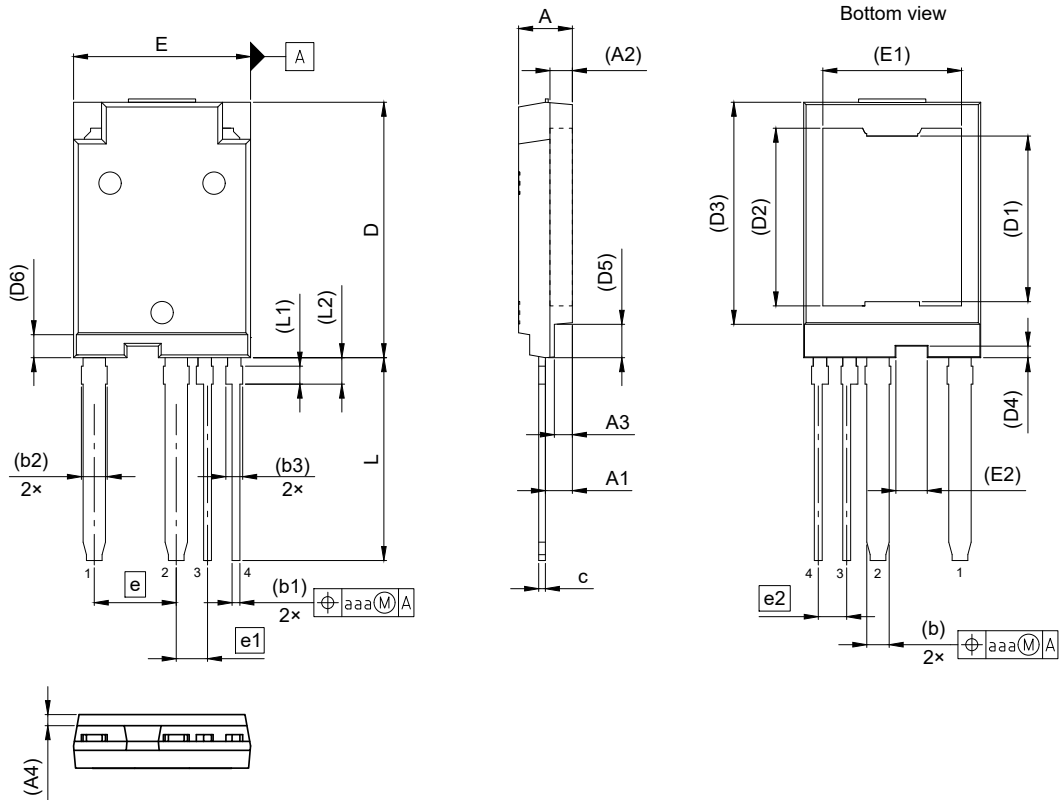
**Typical diode current slope as a function of gate resistor**

$di_F/dt = f(R_G)$

$V_R = 470 \text{ V}, I_F = 160 \text{ A}$



## 5 Package outlines



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

Figure 1



## 6 Testing conditions

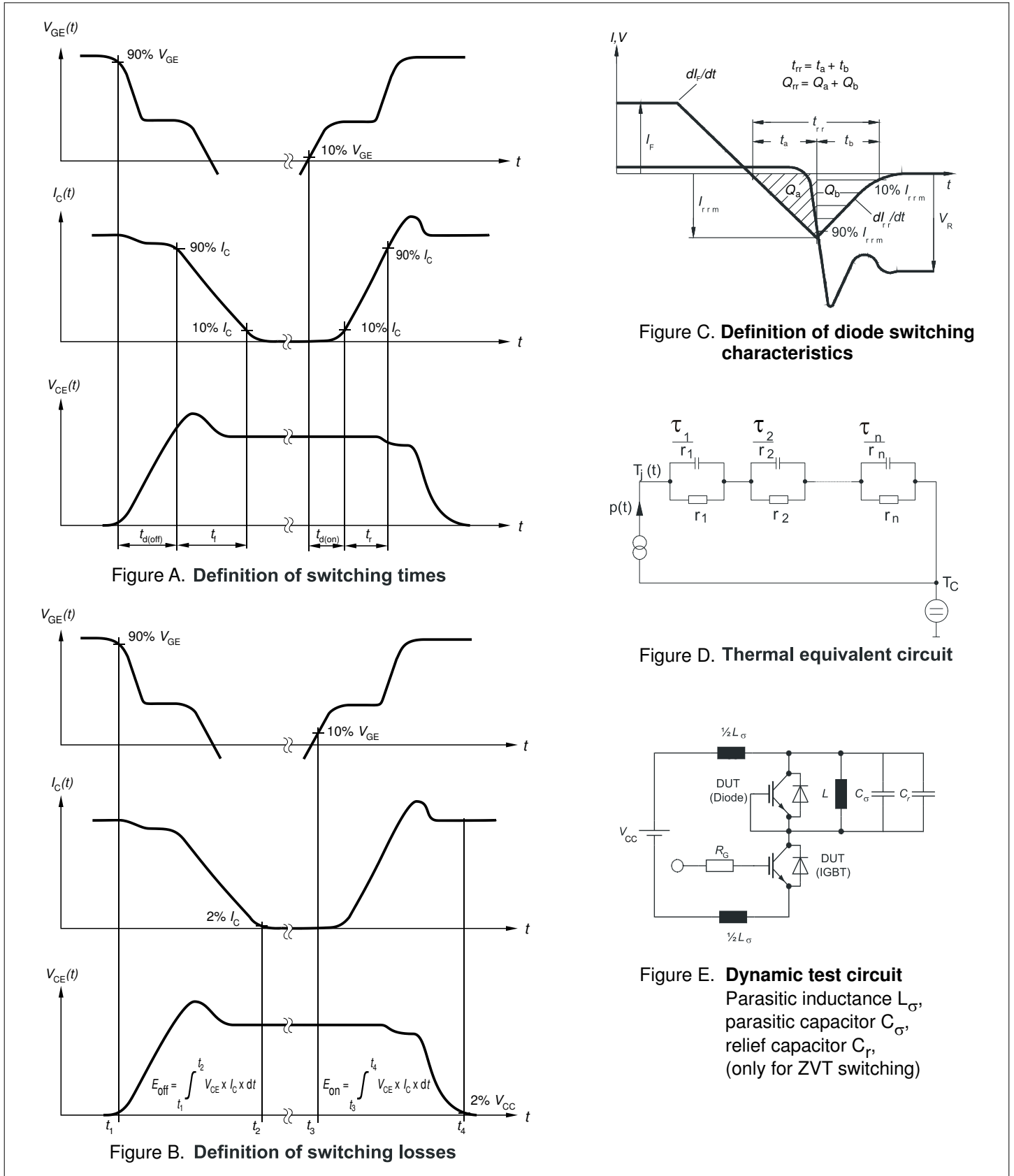


Figure 2

## Revision history

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

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**Document reference**

**IFX-ABB842-003**

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