FGA4060ADF-VB Datasheet

600V Trench and Fieldstop IGBT

PRODUCT SUMMARY		
V_{CE} (V)	600	
I_C (A)	120 (TC=25°C)	60 (TC=100°C)
V_{CE} (sat) (V)	1.8	
I_{CM} (A)	180	

FEATURES

- Very Low VCEsat
- Low turn-off losses
- High speed switching
- Maximum junction temperature 175°C
- Ultra low gate charge (Q_g)
- Avalanche energy rated (UIS)

RoHS COMPLIANT
HALOGEN FREE

APPLICATIONS

- Telecommunications
  - Server and telecom power supplies
- Lighting
  - High-intensity discharge (HID)
  - Fluorescent ballast lighting
- Consumer and computing
  - ATX power supplies
- Industrial
  - Welding
  - Battery chargers
- Renewable energy
  - Solar (PV inverters)
- Switch mode power supplies (SMPS)

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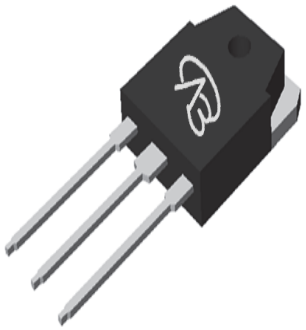
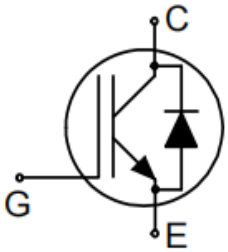


Top View



Package pin definition

- Pin1 G - Gate
- Pin2 C & backside - Collector
- Pin3 E - Emitter

ABSOLUTE MAXIMUM RATINGS (T_C = 25 °C, unless otherwise noted)

PARAMETER			SYMBOL	LIMIT	UNIT
Collector-Emitter Voltage			V_{CE}	600	V
Gate-Emitter Voltage			V_{GE}	±30	
Continuous Collector Current (T_J = 150 °C)	V_{GE} at 15 V	T_C = 25 °C	I_C	120	A
		T_C = 100 °C		60	
Pulsed Collector Current [a]			I_{CM}	180	
Diode Forward Current [b]			I_F	50	A
Maximum Power Dissipation		T_C = 25 °C	P_D	96	W
		T_C = 100 °C		18.0	W
Operating Junction and Storage Temperature Range			T_J, T_{stg}	-55 to +175	°C
Short Circuit Withstand Time TC=150°C	VGE= 15V, VCE≤ 400V		tsc	3	μs
Short Circuit Withstand Time TC=100°C	VGE= 15V, VCE≤330V			5	
Soldering Recommendations (Peak Temperature) [c]	for 10 s			260	°C

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature.

b. Current limited by maximum junction temperature.

c. 1.6 mm from case.

THERMAL RESISTANCE RATINGS				
PARAMETER	**SYMBOL**	**TYP.**	**MAX.**	**UNIT**
Maximum Junction-to-Ambient	R_{thJA}	-	78	°C/W
Maximum Junction-to-Case	R_{thJC}	-	3.6	

SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)							
PARAMETER	**SYMBOL**	**TEST CONDITIONS**		**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static							
Collector-Emitter Breakdown Voltage	BV_{CE}	V_{GE} = 0 V, I_C = 250 μA		600	-	-	V
		V_{GE} = 0 V, I_C = 1 mA		600	-	-	
Gate-Source Threshold Voltage (N)	$V_{GE(th)}$	V_{CE} = V_{GE}, I_D = 250 μA		4	5	6	V
Zero Gate Voltage Collector Current	I_{CES}	V_{CE} = 600 V, V_{GE} = 0 V, T_J = 25 °C		-	1	20	μA
		V_{CE} = 600 V, V_{GE} = 0 V, T_J = 150 °C		-	1000	-	μA
Gate-Emitter Leakage Current	I_{GES}	V_{CE} = 0 V, V_{GS} = ± 2 0 V		-	-	100	nA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE} = 7 V	I_C = 60 A	-	1.7	2.1	V
Forward Transconductance	g_{fs}	V_{CE} = 20 V, I_C = 60 A		-	15	-	S
Dynamic							
Input Capacitance	C_{ies}	V_{GE} = 0 V, V_{CE} = 25 V, f = 500 KHz		-	6500	-	pF
Output Capacitance	C_{oes}			-	62	-	
Reverse Transfer Capacitance	C_{res}			-	53	-	
Turn-on Energy	E_{on}	V_{CE} = 400 V , V_{GE} = 0 /15V, I_C = 60 A, R_g = 10Ω		-	0.62	-	nJ
Turn-off Energy	E_{off}			-	0.25	-	
Total Gate Charge	Q_g	V_{GE} = 7 V	I_C = 60 A, V_{CE} = 400 V	-	7 8	-	nC
Gate-Emitter Charge	Q_{ge}			-	24	-	
Gate to Collector Charge	Q_{gc}			-	23	-	
Turn-On Delay Time	$t_{d(on)}$	V_{CE} = 400 V , V_{GE} = 0 /15V, I_C = 60 A, R_g = 10Ω		-	18	-	ns
Rise Time	t_r			-	64	-	
Turn-Off Delay Time	$t_{d(off)}$			-	1 6 3	-	
Fall Time	t_f			-	52	-	
Internal emitter inductance measured 5 mm	L_E			-	13	-	nH
Diode Characteristics							
Diode Forward Current	I_F	IGBT symbol showing the integral reverse junction diode		-	-	60	A
Pulsed Diode Forward Current	I_{FM}			-	-	180	
Diode Forward Voltage	V_F	I_F = 60 A		-	1.96	4.0	V
Reverse Recovery Time	t_{rr}	T_J = 25 °C, I_F = 60 A, dI_F/dt = 200 A/μs, V_R = 400 V		-	88	-	ns
Reverse Recovery Charge	Q_{rr}			-	0.56	-	μC
Reverse Recovery Current	I_{RRM}			-	13	-	A

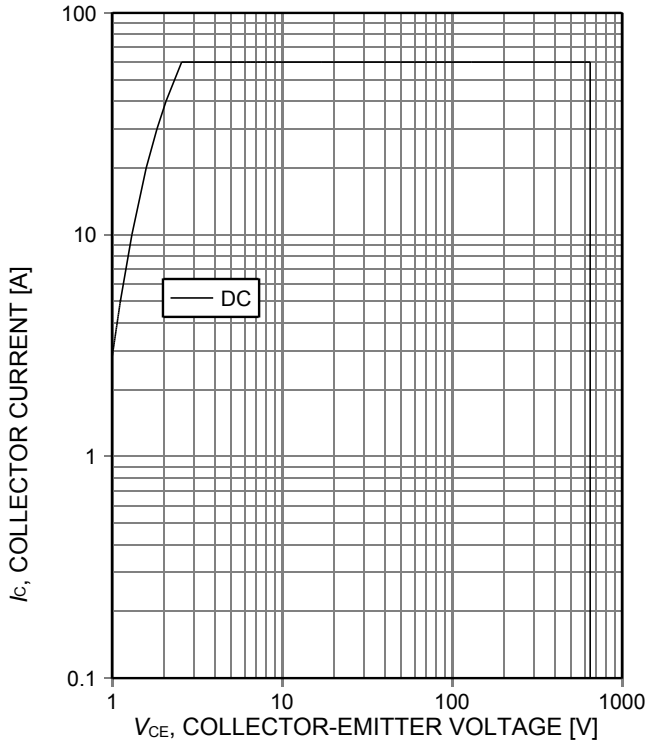


Figure 1. **Forward bias safe operating area** (D=0, T_C=25°C, T_{vj}≤175°C; V_{GE}=15V. Recommended use at V_{GE}≥7.5V)

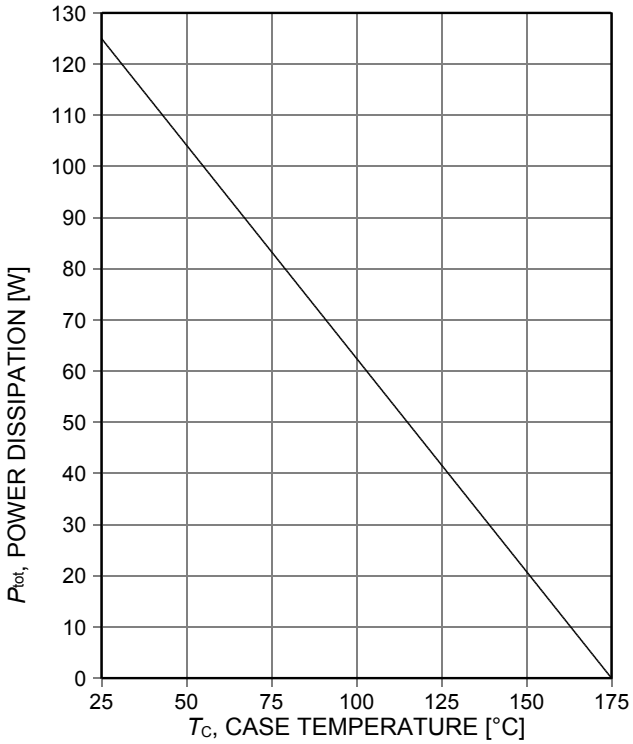


Figure 2. **Power dissipation as a function of case temperature** (T_{vj}≤175°C)

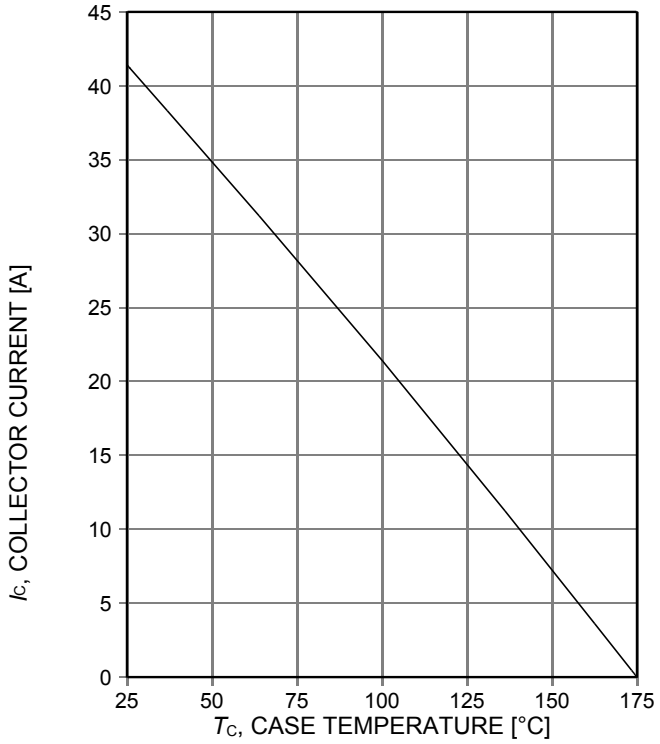


Figure 3. **Collector current as a function of case temperature**

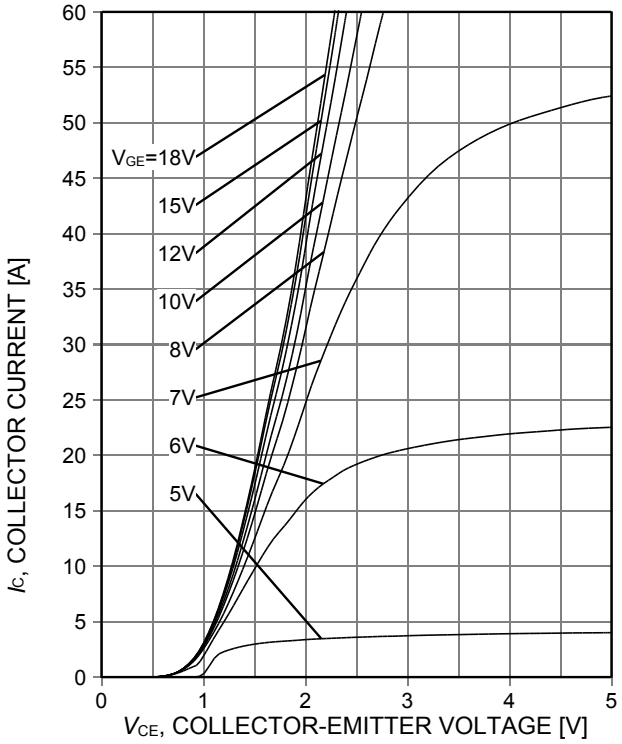


Figure 4. **Typical output characteristic**

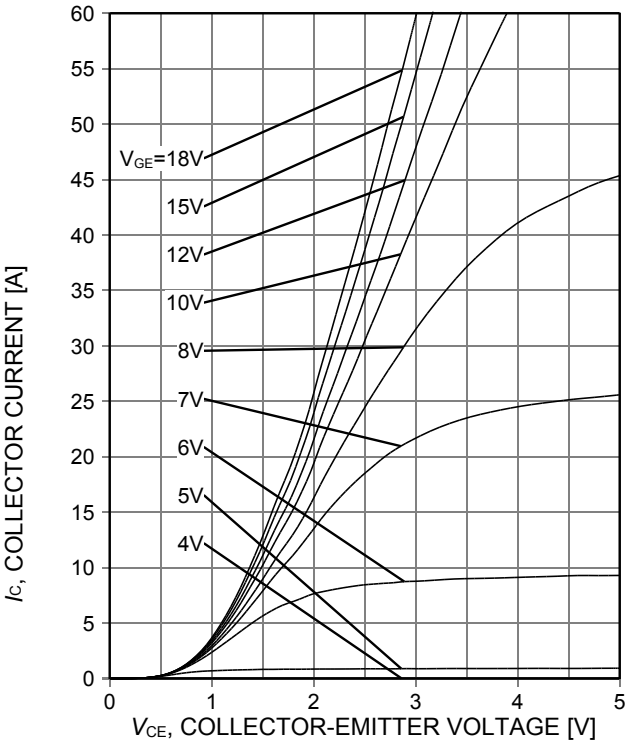


Figure 5. **Typical output characteristic** (T_{vj}=150°C)

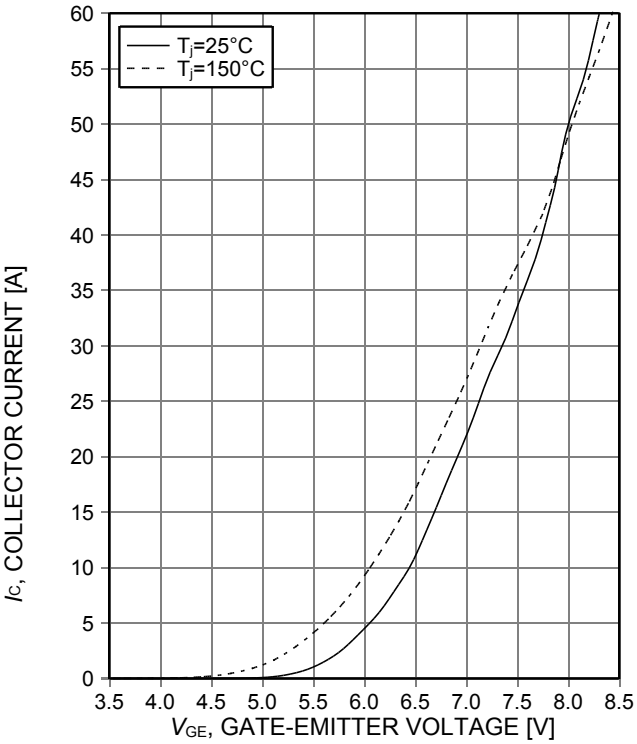


Figure 6. **Typical transfer characteristic** (V_{CE}=20V)

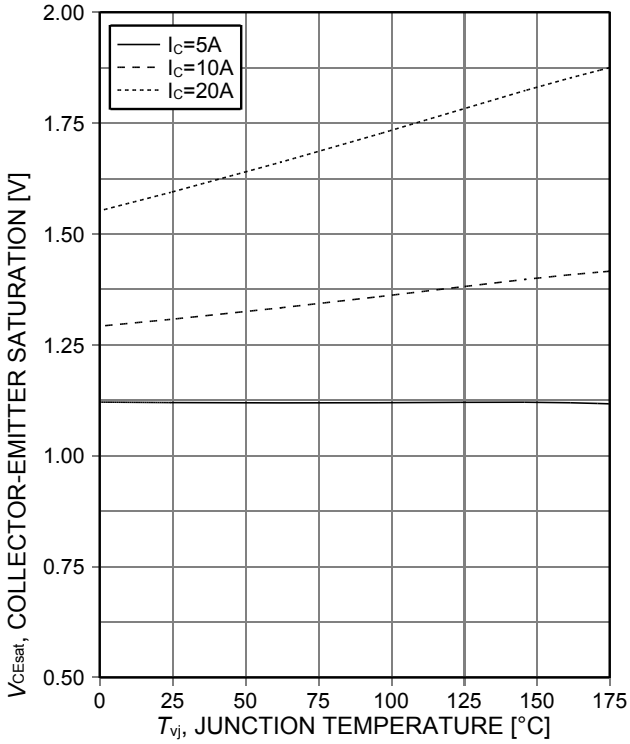


Figure 7. **Typical collector-emitter saturation voltage as a function of junction temperature**

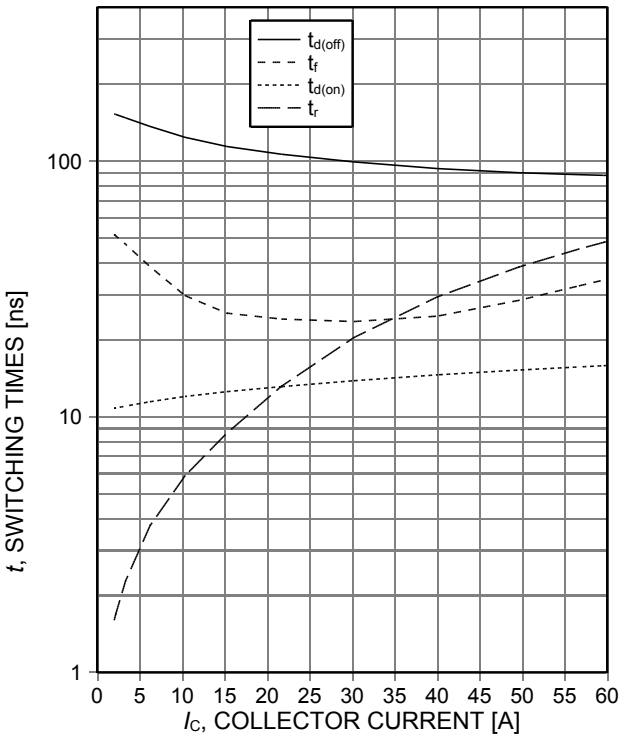


Figure 8. **Typical switching times as a function of collector current**

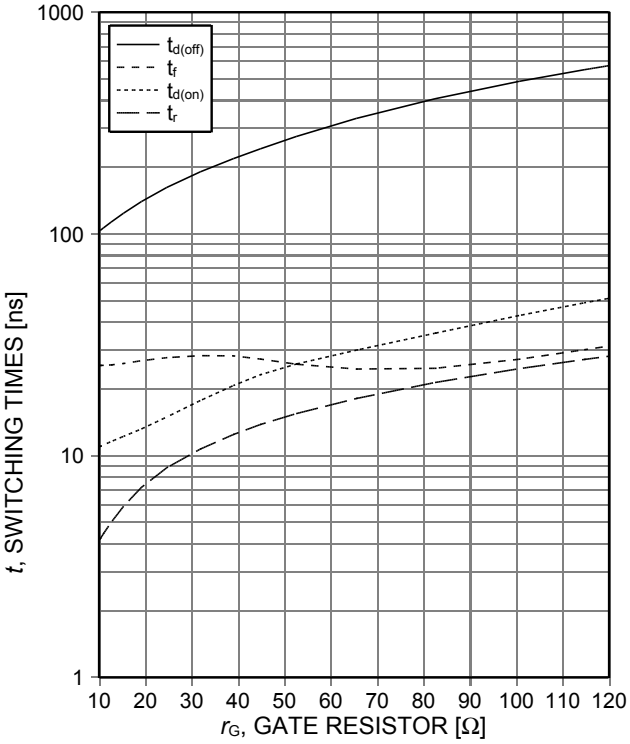


Figure 9. **Typical switching times as a function of gate resistor**

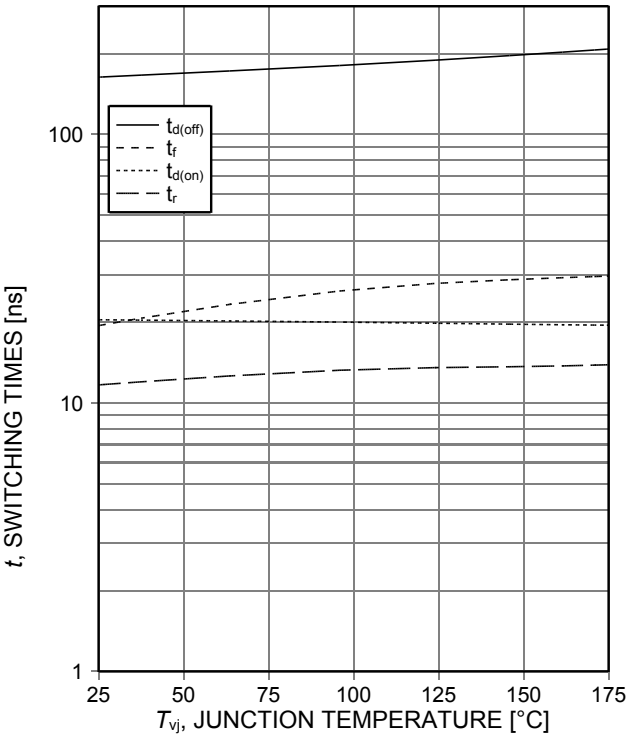


Figure 10. **Typical switching times as a function of junction temperature**

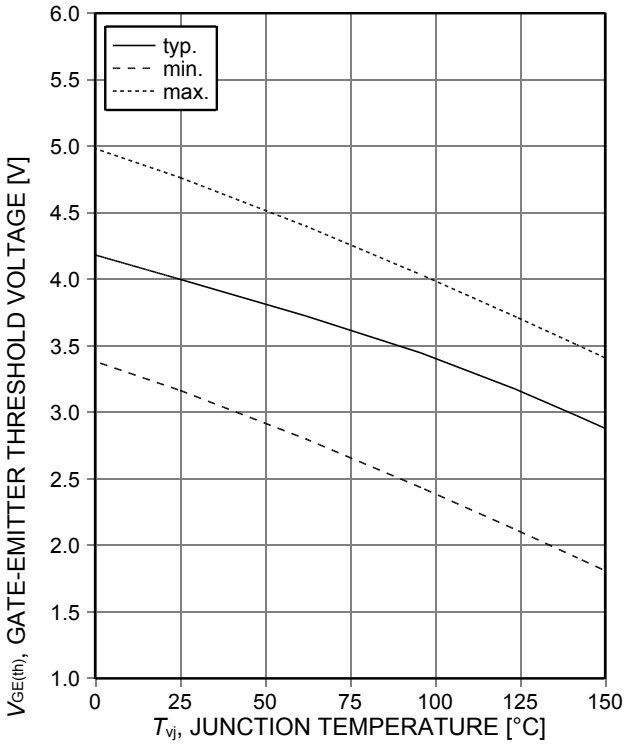


Figure 11. **Gate-emitter threshold voltage as a function of junction temperature**

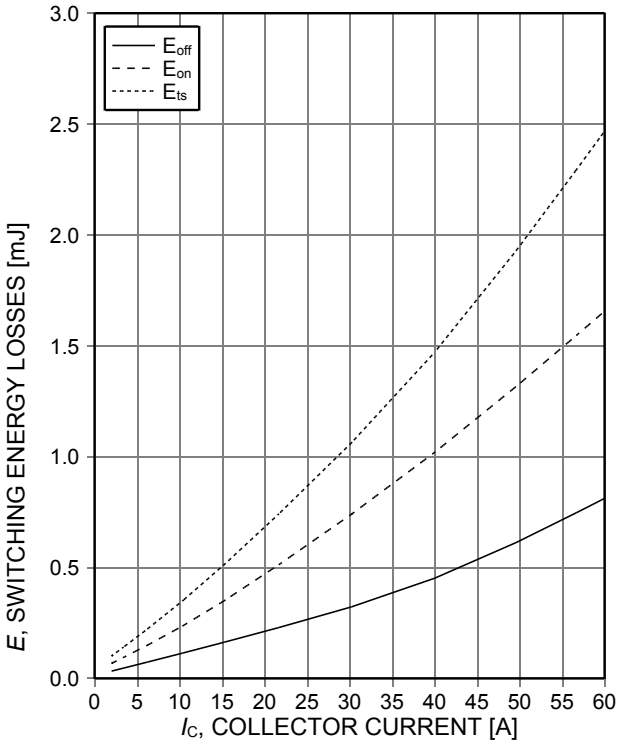


Figure 12. **Typical switching energy losses as a function of collector current**

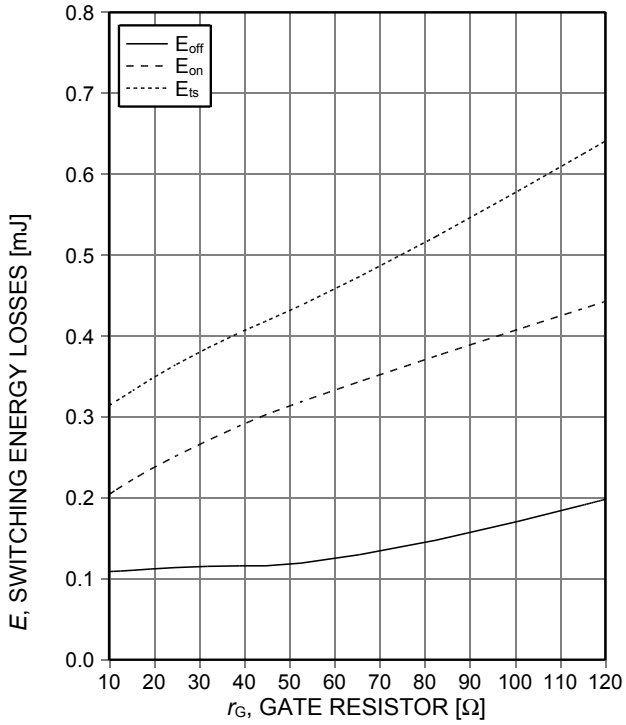


Figure 13. **Typical switching energy losses as a function of gate resistor**

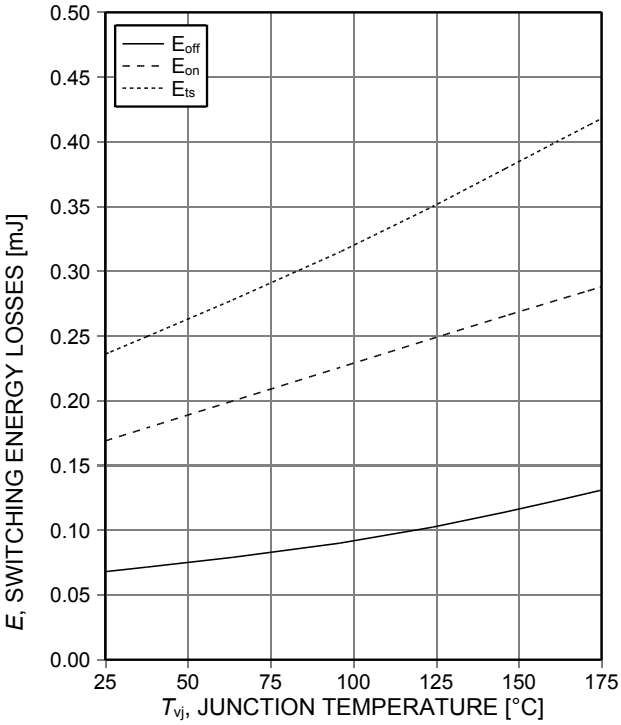


Figure 14. **Typical switching energy losses as a function of junction temperature**

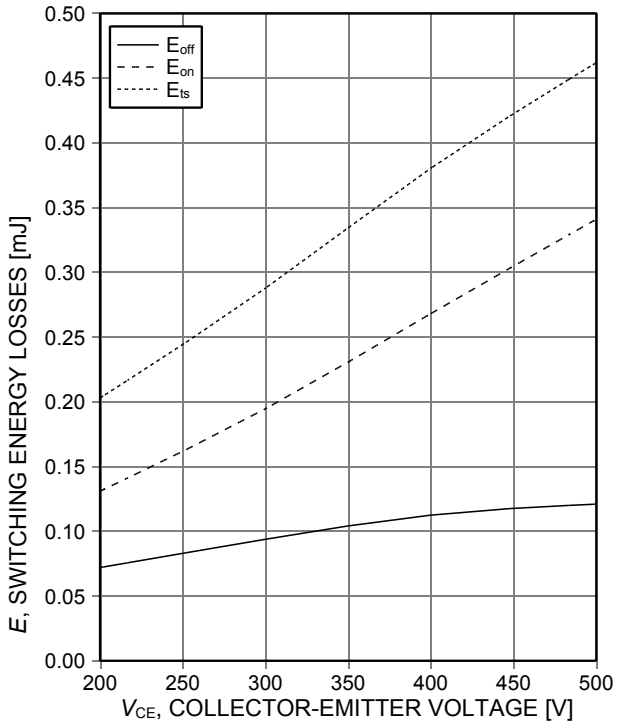


Figure 15. **Typical switching energy losses as a function of collector emitter voltage**

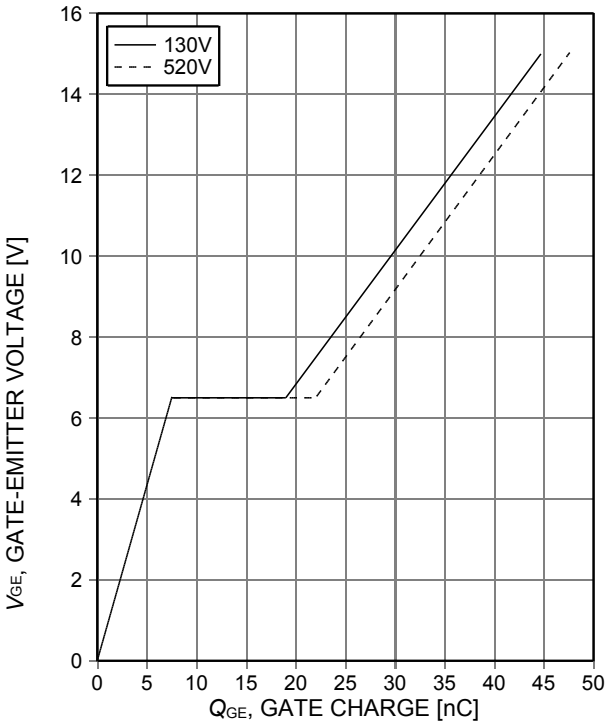


Figure 16. **Typical gate charge**

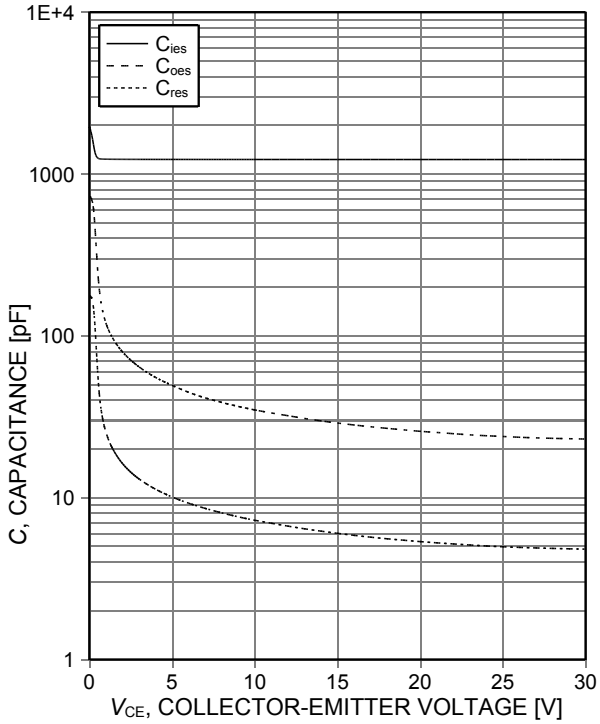


Figure 17. **Typical capacitance as a function of collector-emitter voltage**

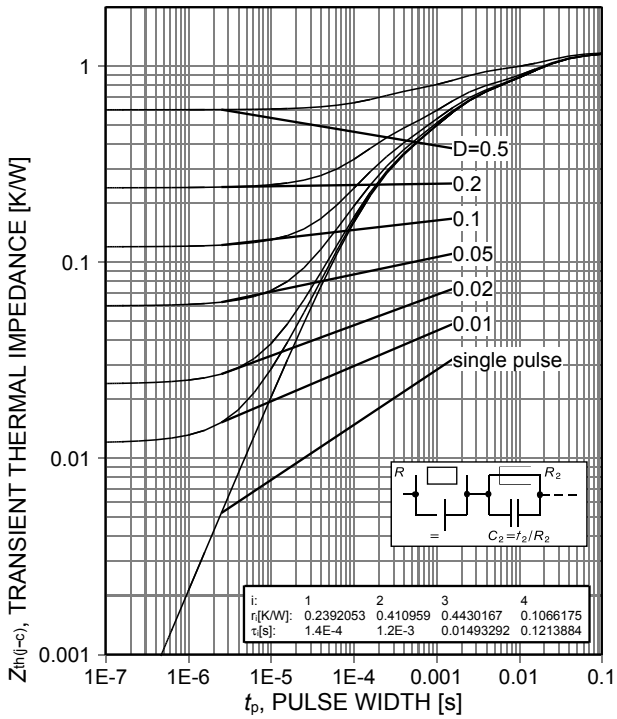


Figure 18. **IGBT transient thermal impedance**

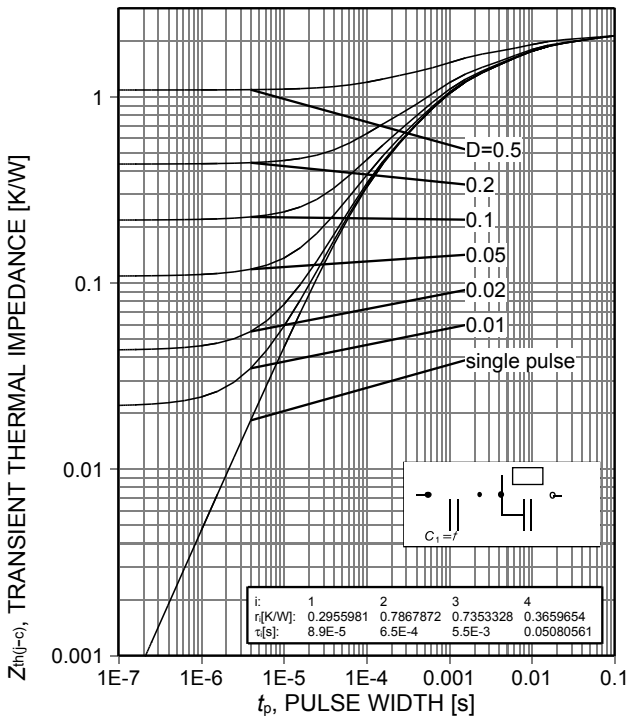


Figure 19. **Diode transient thermal impedance as a function of pulse width**

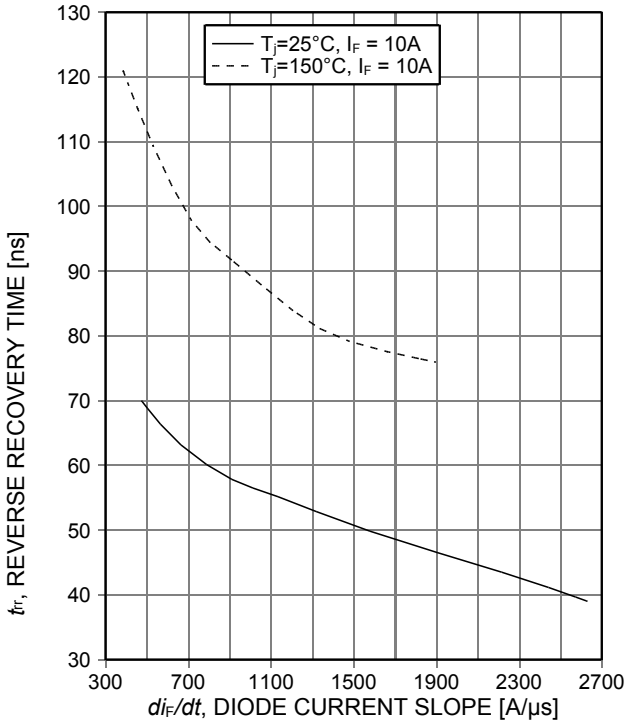


Figure 20. **Typical reverse recovery time as a function of diode current slope**

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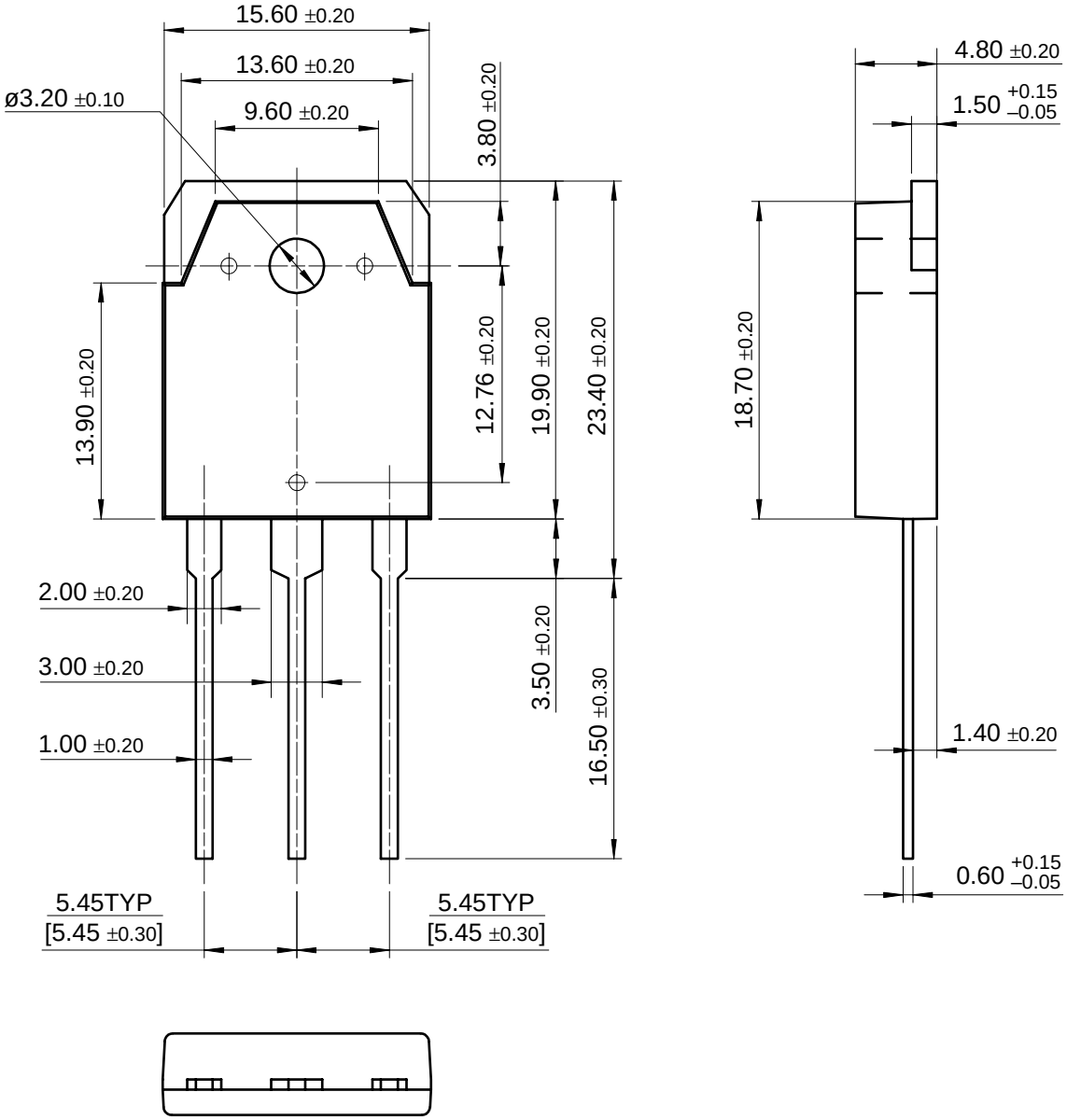
15.60 ±0.20
13.60 ±0.20
9.60 ±0.20
ø3.20 ±0.10
3.80 ±0.20
13.90 ±0.20
12.76 ±0.20
19.90 ±0.20
23.40 ±0.20
2.00 ±0.20
3.00 ±0.20
1.00 ±0.20
3.50 ±0.20
16.50 ±0.30
5.45TYP
[5.45 ±0.30]
5.45TYP
[5.45 ±0.30]
4.80 ±0.20
1.50 +0.15 −0.05
18.70 ±0.20
1.40 ±0.20
0.60 +0.15 −0.05

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