

650 V Trench and Fieldstop IGBT

PRODUCT SUMMARY		
V_{CE} (V)	650	
I_C (A)	120 ($T_C=25^\circ\text{C}$)	60 ($T_C=100^\circ\text{C}$)
$V_{CE(sat)}$ (V)	1.7	
I_{CM} (A)	180	

FEATURES

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



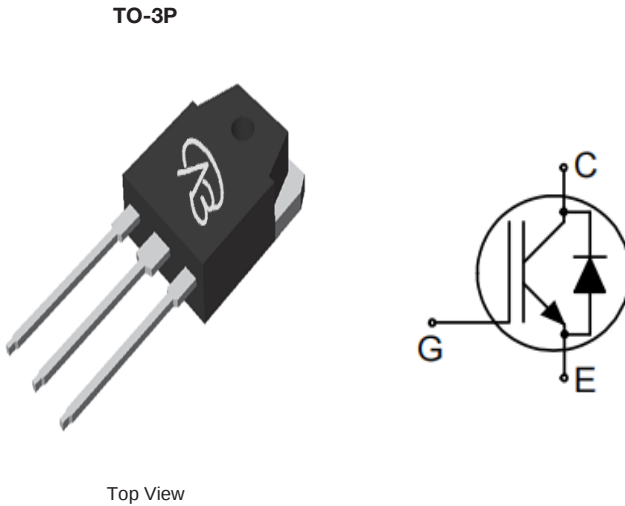
RoHS
COMPLIANT
HALOGEN
FREE

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)

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}	650	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	60	A
Maximum Power Dissipation		T _C = 25 °C	P _D	450	W
		T _C = 100 °C		200	W
Operating Junction and Storage Temperature Range			T _J , T _{stg}	-55 to +175	°C
Short Circuit Withstand Time ^{TC=150}	VGE= 15V, VCE ≤ 400V		tsc	3	μs
Short Circuit Withstand Time ^{TC=100}	VGE= 15V, VCE ≤ 330V			5	
Soldering Recommendations (Peak Temperature) ^c	for 10 s			260	°C

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- Current limited by maximum junction temperature.
- 1.6 mm from case.

THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	40	°C/W
Maximum Junction-to-Case	R_{thJC}	-	0.5	

SPECIFICATIONS ($T_J = 25\text{ }^{\circ}\text{C}$, 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 V _{GE} = 0 V, I _C = 1 mA		650 650	- -	- -	V
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} = 650 V,V _{GE} = 0 V,T _J = 25 °C		-	1	20	μA
		V _{CE} = 650 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} = 15 V	I _C = 60 A	-	1.8	2.1	V
Forward Transconductance	g _{fs}	V _{CE} = 20 V, I _C = 60 A		-	40	-	S
Dynamic							
Input Capacitance	C _{ies}	V _{GE} = 0 V, V _{CE} = 25 V, f = 500 KHz		-	6210	-	pF
Output Capacitance	C _{oes}			-	228	-	
Reverse Transfer Capacitance	C _{res}			-	60	-	
Turn-on Energy	E _{on}	V _{CE} = 400 V , V _{GE} = 0 /15V, I _C = 60 A, R _g = 10Ω		-	0.76	-	nJ
Turn-off Energy	E _{off}			-	0.26	-	
Total Gate Charge	Q _g	V _{GE} = 15 V	I _C = 60 A, V _{CE} = 400 V	-	165	-	nC
Gate-Emitter Charge	Q _{ge}			-	18	-	
Gate to Collector Charge	Q _{gc}			-	2 3	-	
Turn-On Delay Time	t _{d(on)}	V _{CE} = 400 V , V _{GE} = 0 /15V, I _C = 60 A, R _g = 10Ω		-	72	-	ns
Rise Time	t _r			-	42	-	
Turn-Off Delay Time	t _{d(off)}			-	170	-	
Fall Time	t _f			-	26	-	
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		-	1.50	2.0	V
Reverse Recovery Time	t _{rr}	T _J = 25 °C, I _F = 60 A, dI _F /dt = 200 A/μs, V _R = 400 V		-	60	-	ns
Reverse Recovery Charge	Q _{rr}			-	0.3	-	μC
Reverse Recovery Current	I _{RRM}			-	11	-	A

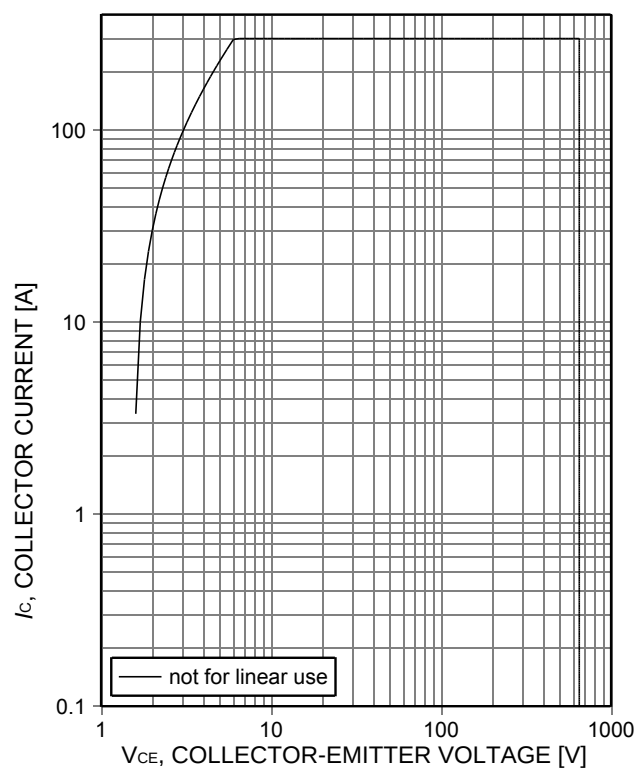


Figure 1. Forward bias safe operating area

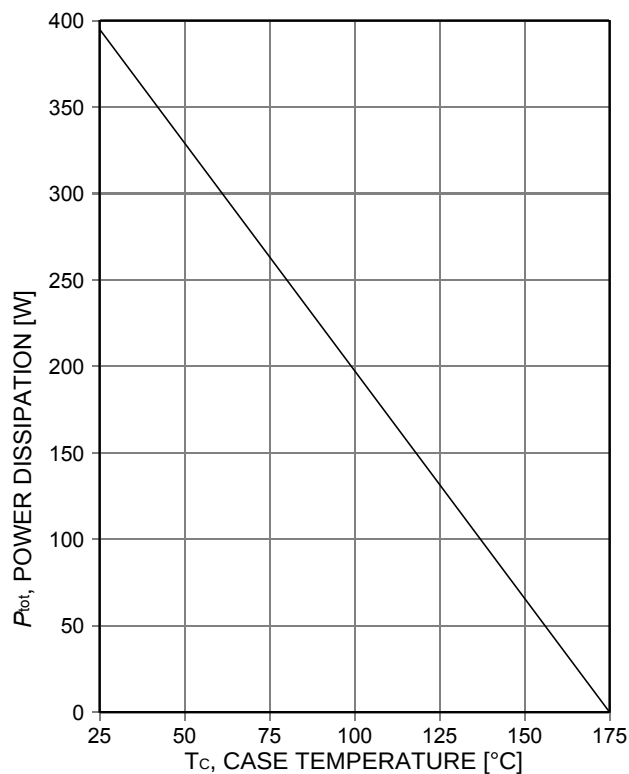


Figure 2. Power dissipation as a function of case

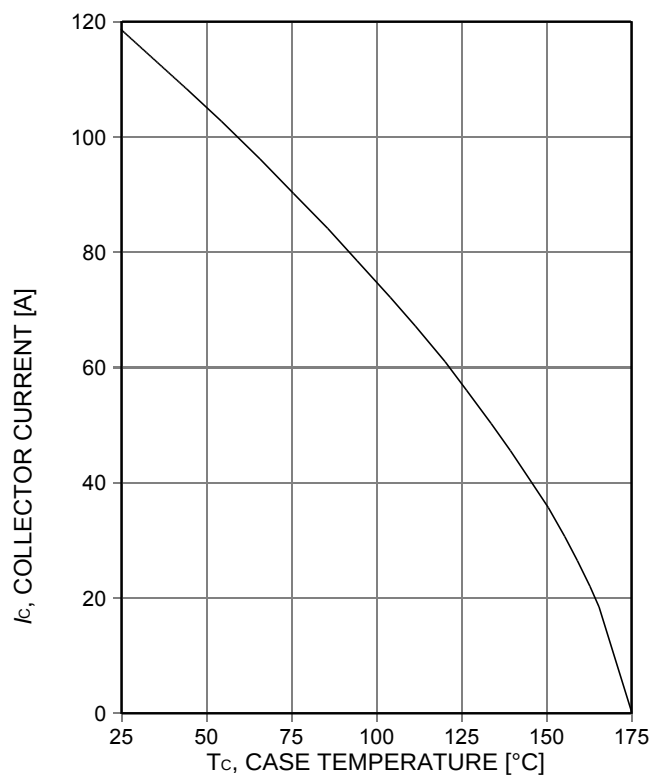


Figure 3. Collector current as a function of case temperature

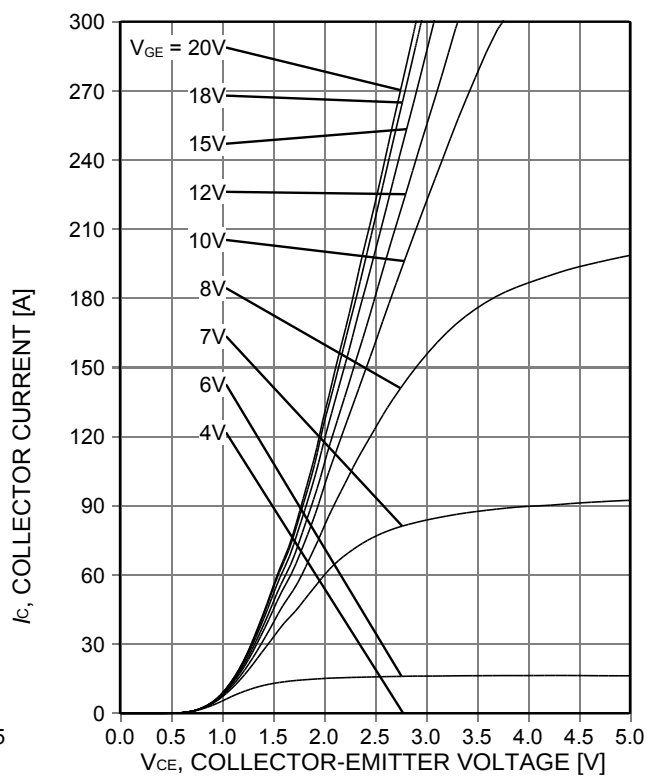


Figure 4. Typical output characteristic

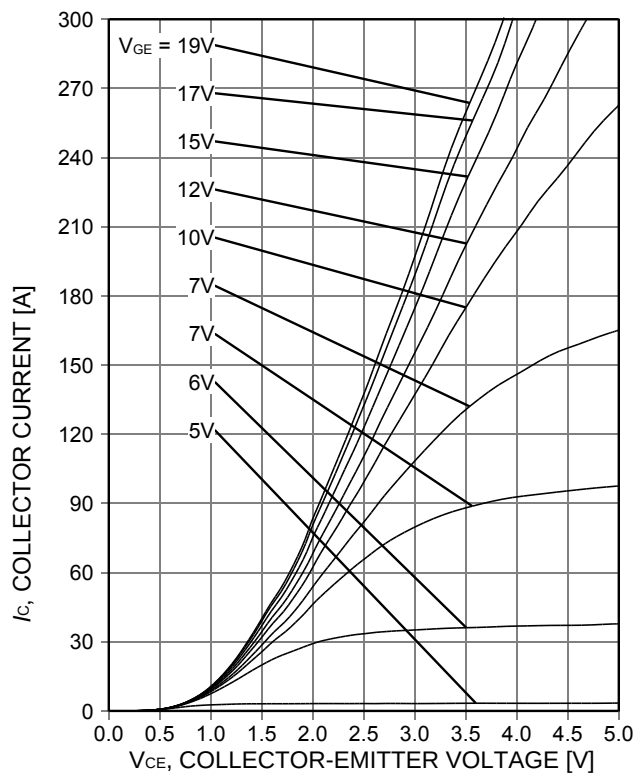


Figure 5. Typical output characteristic

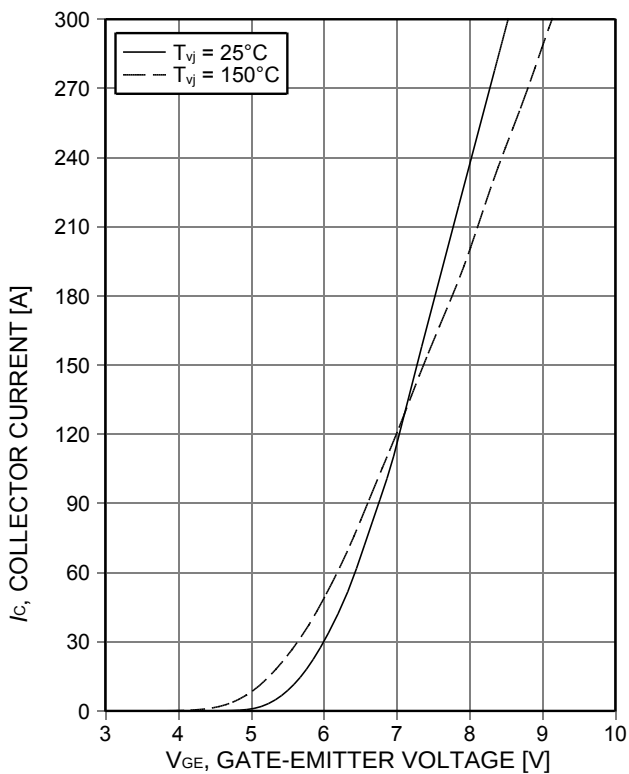


Figure 6. Typical transfer characteristic

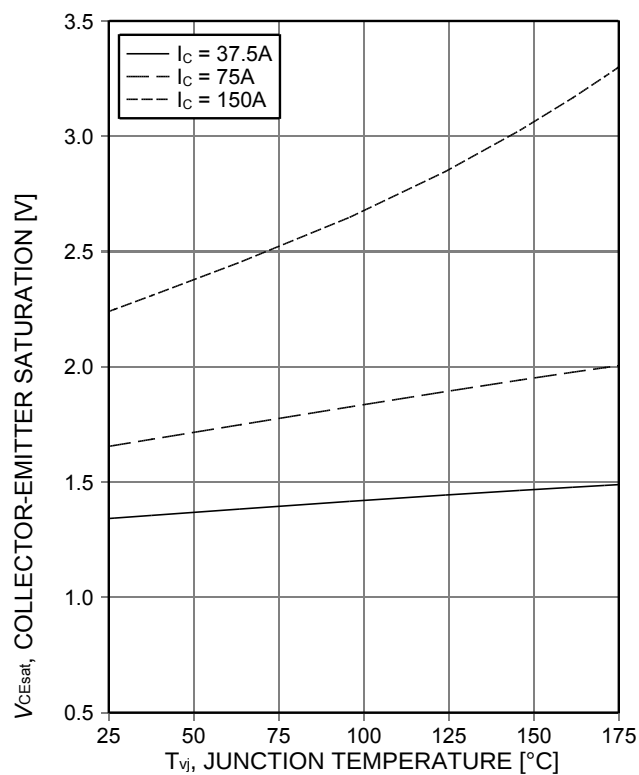


Figure 7. Typical collector-emitter saturation voltage as a function of junction temperature

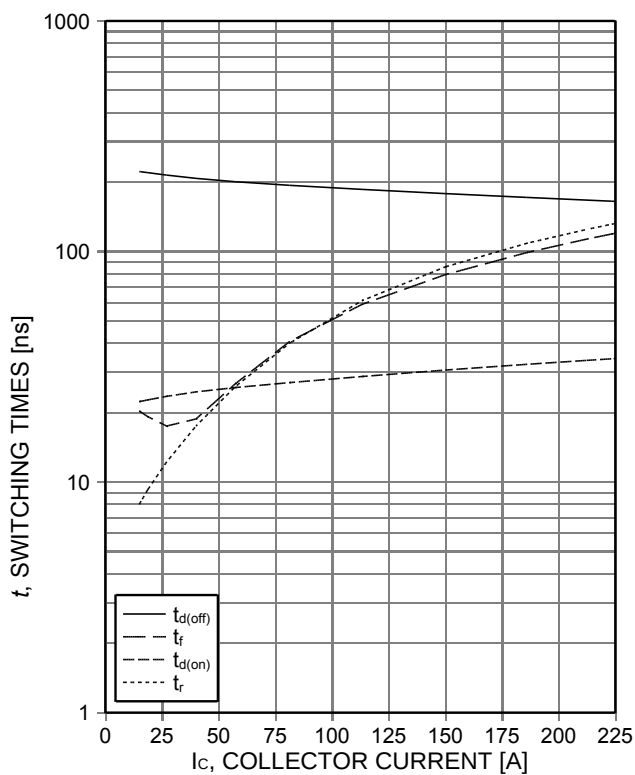


Figure 8. Typical switching times as a function of collector current

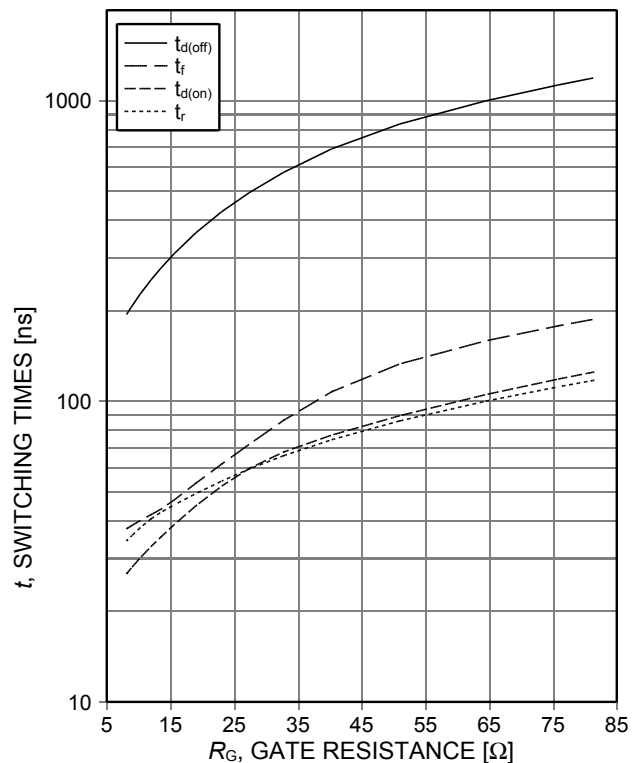


Figure 9. Typical switching times as a function of gate resistance

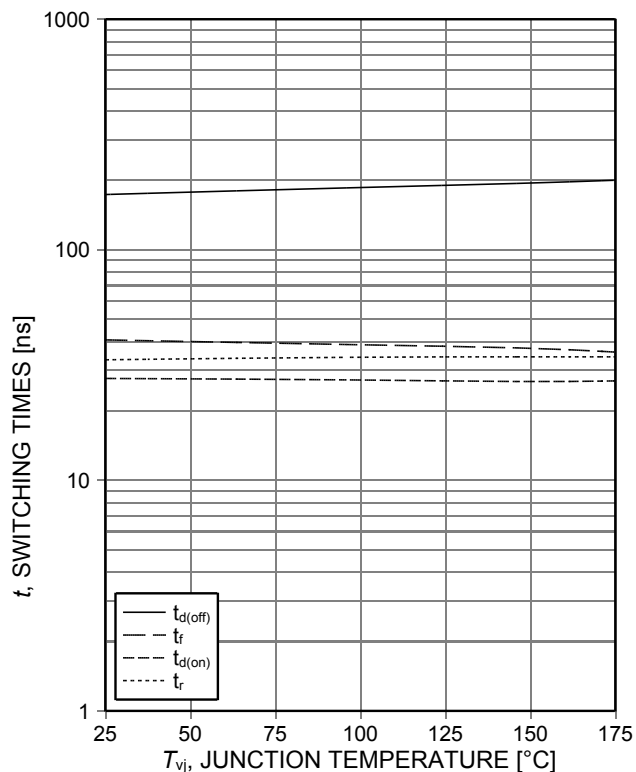


Figure 10. Typical switching times as a function of junction temperature

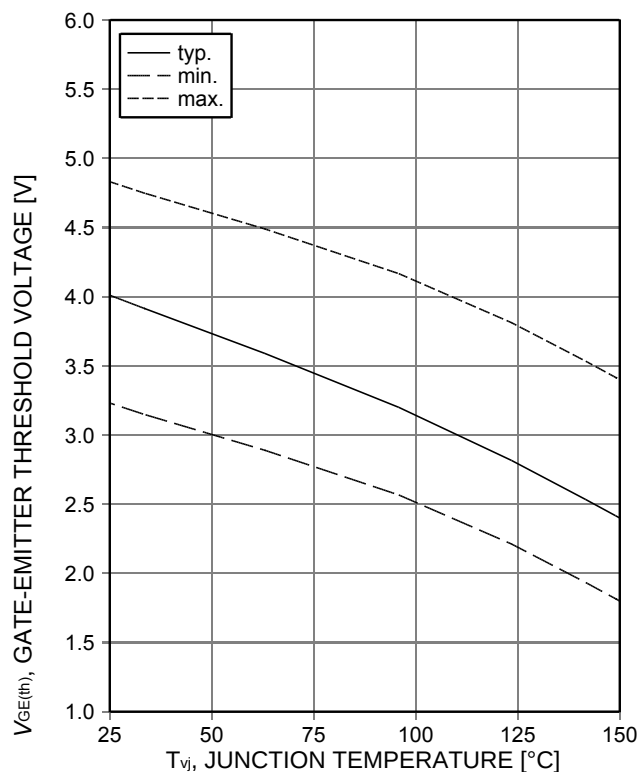


Figure 11. Gate-emitter threshold voltage as a function of junction temperature

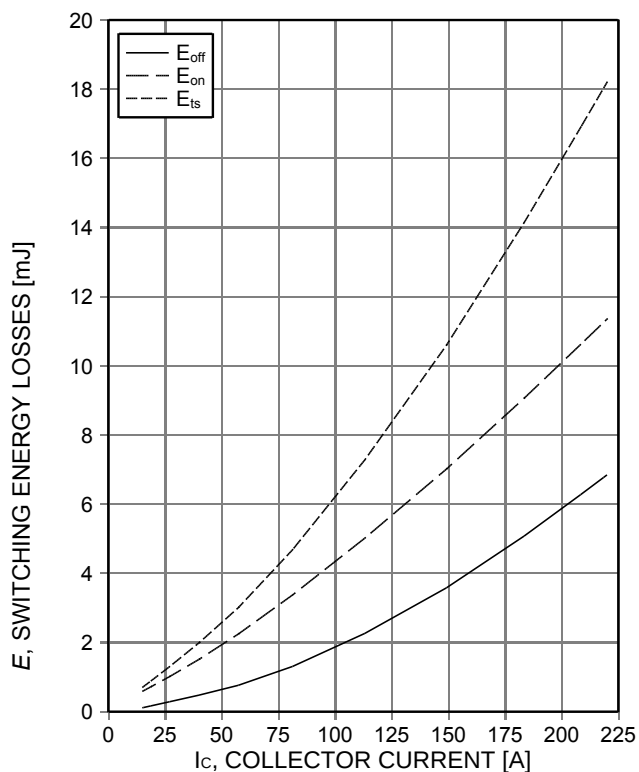


Figure 12. Typical switching energy losses as a function of collector current

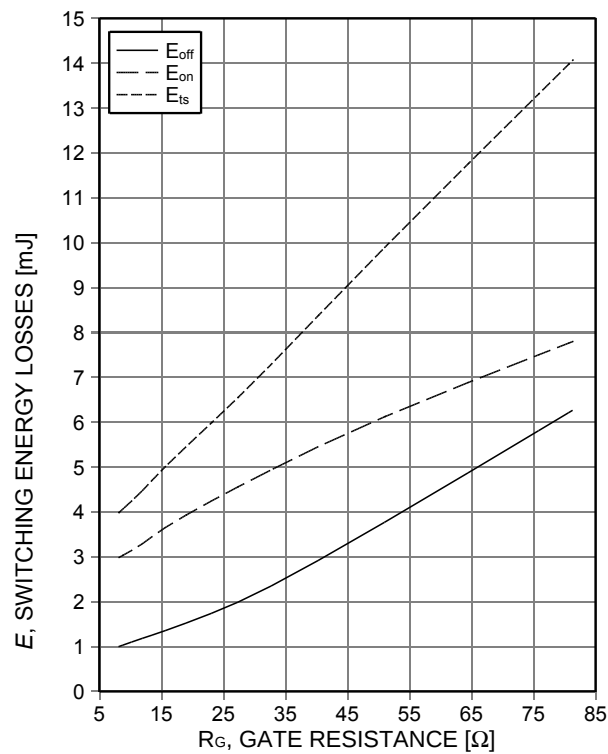


Figure 13. Typical switching energy losses as a function of gate resistance

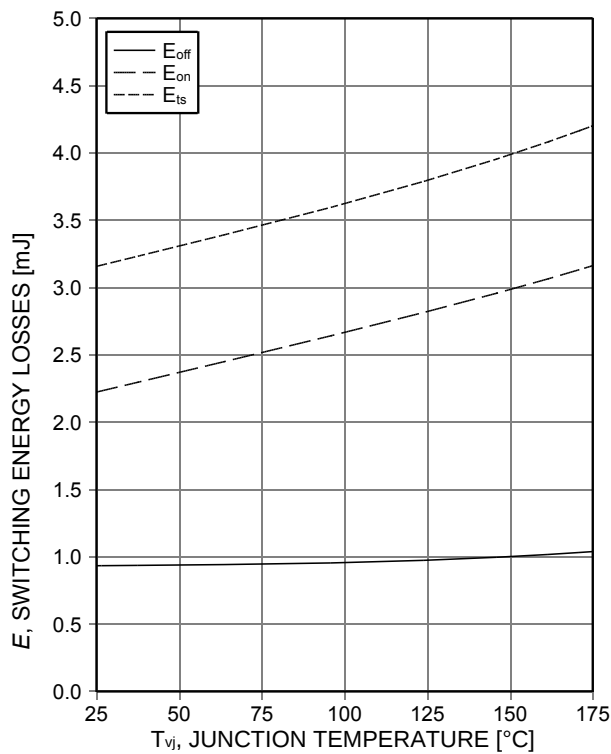


Figure 14. Typical switching energy losses as a function of junction temperature

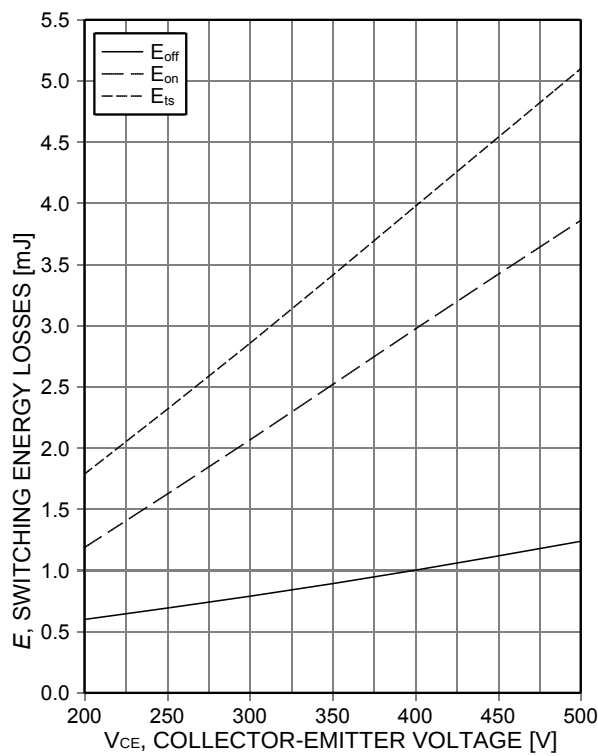


Figure 15. Typical switching energy losses as a function of collector emitter voltage

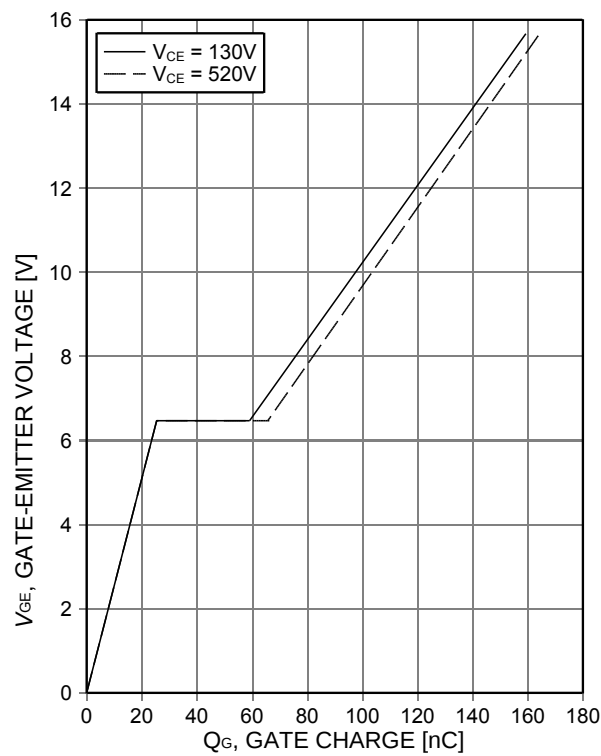


Figure 16. Typical gate charge

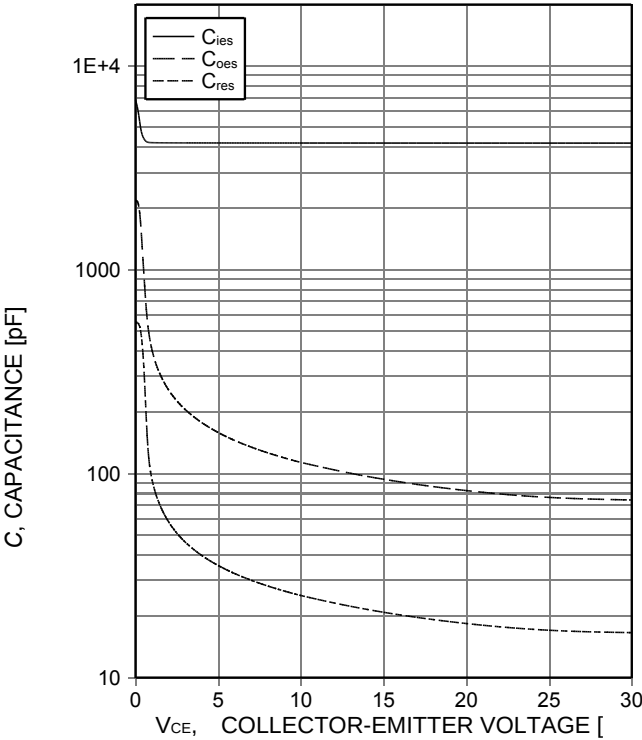


Figure 17. Typical capacitance as a function of collector-emitter voltage

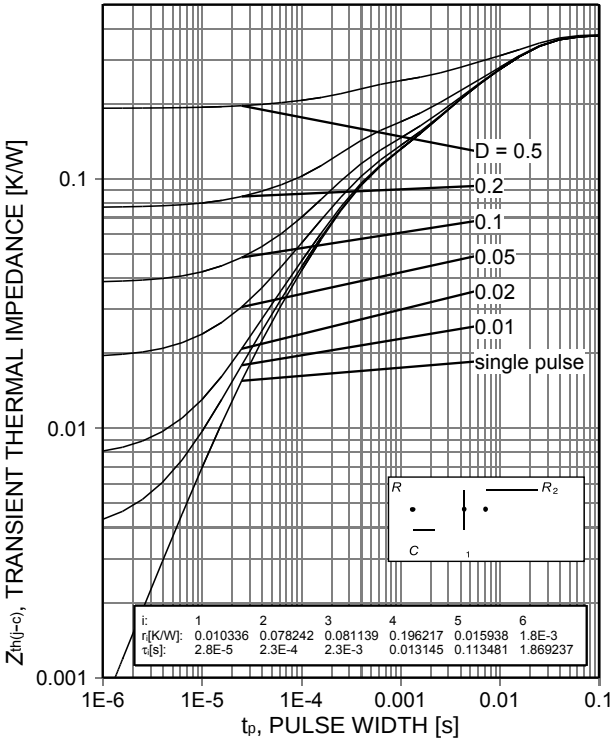
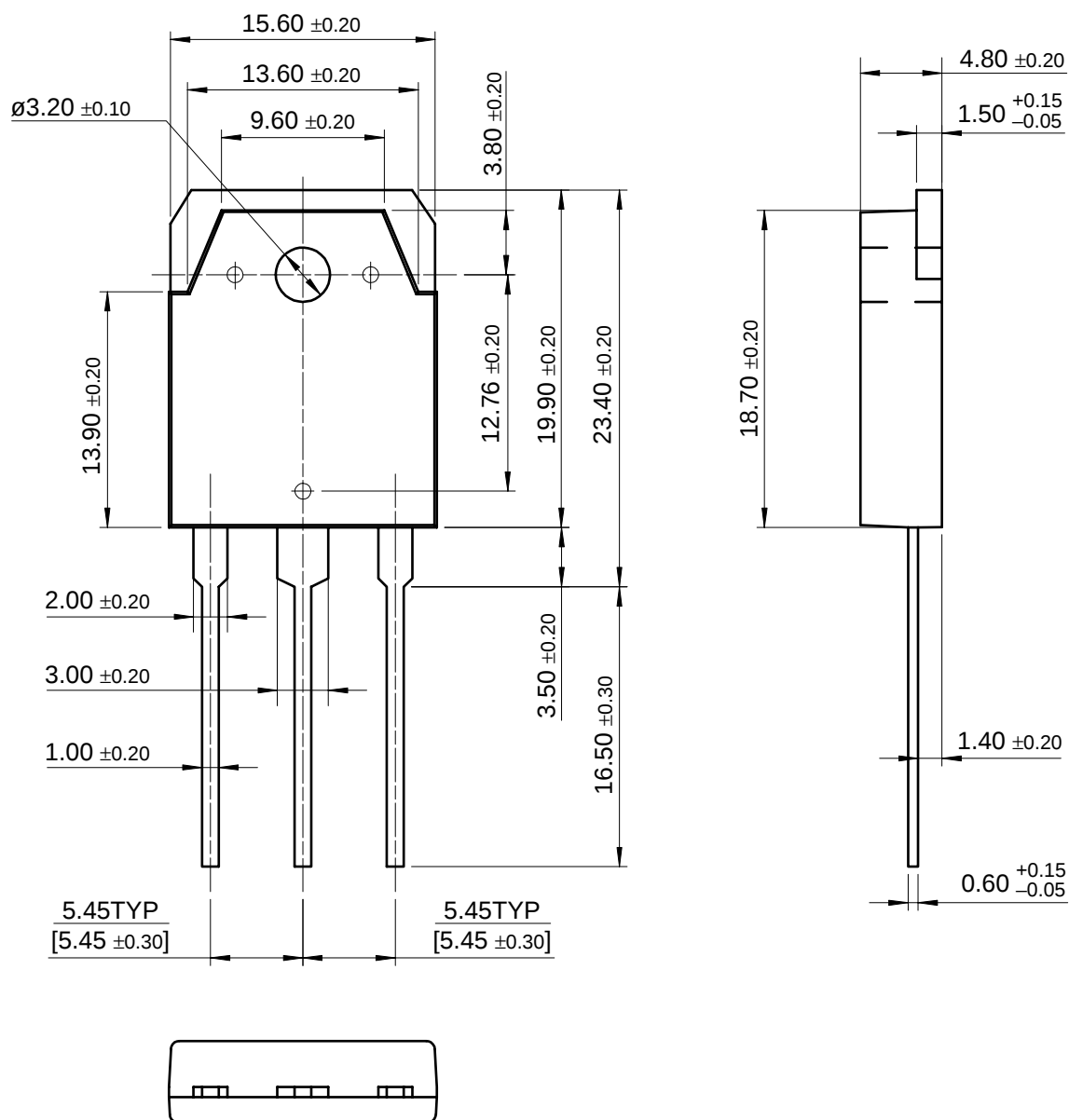


Figure 18. IGBT transient thermal impedance

TO-3P



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