

600V Trench and Fieldstop IGBT

PRODUCT SUMMARY		
V_{CE} (V)	600	
I_C (A)	40 (TC=25 °C)	20 (TC=100 °C)
$V_{CE(sat)}$ (V)	1.7	
I_{CM} (A)	60	

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

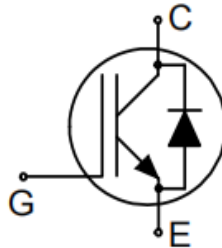
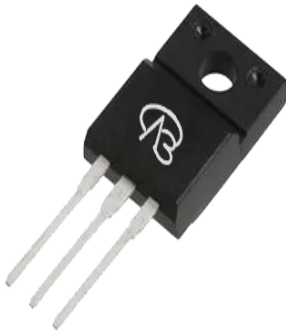
APPLICATIONS

- 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

TO-220F



Top View

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	40	A
		T _C = 100 °C		20	
Pulsed Collector Current ^a			I _{CM}	60	
Diode Forward Current ^b			I _F	20	A
Maximum Power Dissipation			P _D	35	W
				15.6	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}	-	78	°C/W
Maximum Junction-to-Case	R_{thJC}	-	3.6	

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		600 600	- -	- -	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} = 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} = 15 V	I _C = 20 A	-	1.7	2.1	V
Forward Transconductance	g _{fs}	V _{CE} = 20 V, I _C = 20 A		-	16	-	S
Dynamic							
Input Capacitance	C _{ies}	V _{GE} = 0 V, V _{CE} = 25 V, f = 500 KHz		-	2600	-	pF
Output Capacitance	C _{oes}			-	46	-	
Reverse Transfer Capacitance	C _{res}			-	32	-	
Turn-on Energy	E _{on}	V _{CE} = 400 V , V _{GE} = 0 /15V, I _C = 20 A, R _g = 10Ω		-	0.43	-	nJ
Turn-off Energy	E _{off}			-	0.16	-	
Total Gate Charge	Q _g	V _{GE} = 20 V	I _C = 20 A, V _{CE} = 400 V	-	9.7	-	nC
Gate-Emitter Charge	Q _{ge}			-	17	-	
Gate to Collector Charge	Q _{gc}			-	37	-	
Turn-On Delay Time	t _{d(on)}	V _{CE} = 400 V , V _{GE} = 0 /15V, I _C = 20 A, R _g = 10Ω		-	18	-	ns
Rise Time	t _r			-	32	-	
Turn-Off Delay Time	t _{d(off)}			-	105	-	
Fall Time	t _f			-	31	-	
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		-	-	20	A
Pulsed Diode Forward Current	I _{FM}			-	-	60	
Diode Forward Voltage	V _F	I _F = 20 A		-	1.65	2.0	V
Reverse Recovery Time	t _{rr}	T _J = 25 °C, I _F = 20 A, dI _F /dt = 200 A/μs, V _R = 400 V		-	70	-	ns
Reverse Recovery Charge	Q _{rr}			-	0.48	-	μC
Reverse Recovery Current	I _{RRM}			-	8	-	A

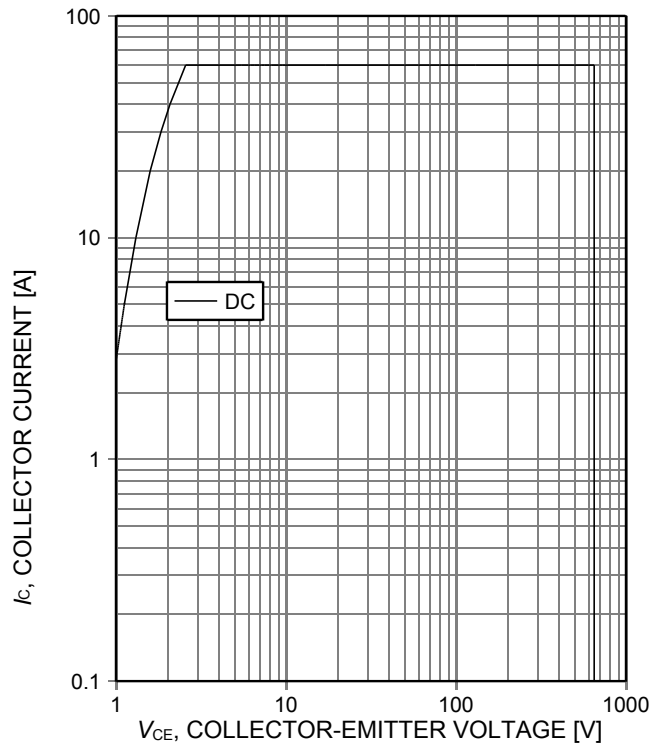


Figure 1. **Forward bias safe operating area**
 $(D=0, T_C=25^{\circ}\text{C}, T_{vj}\leq 175^{\circ}\text{C}; V_{GE}=15\text{V}.$
 Recommended use at $V_{GE}\geq 7.5\text{V}$)

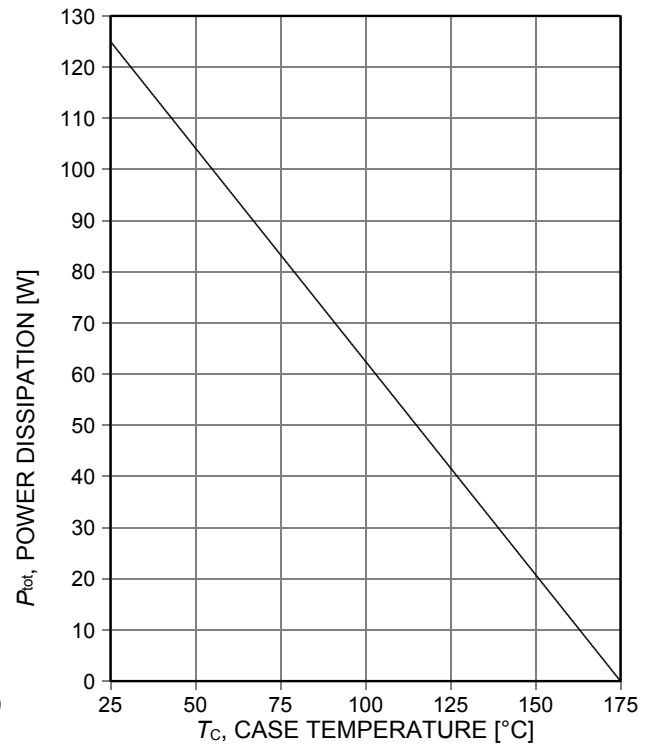


Figure 2. **Power dissipation as a function of case temperature**
 $(T_{vj}\leq 175^{\circ}\text{C})$

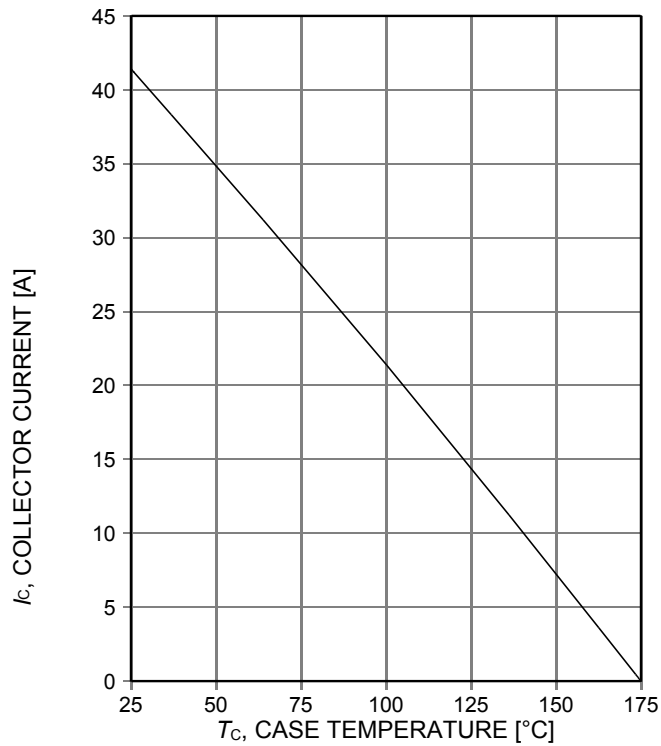


Figure 3. **Collector current as a function of case temperature**

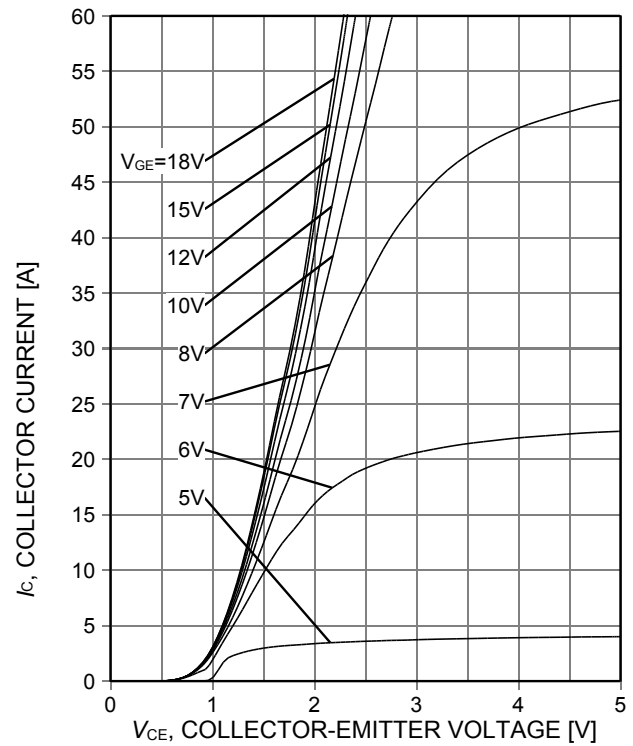


Figure 4. **Typical output characteristic**

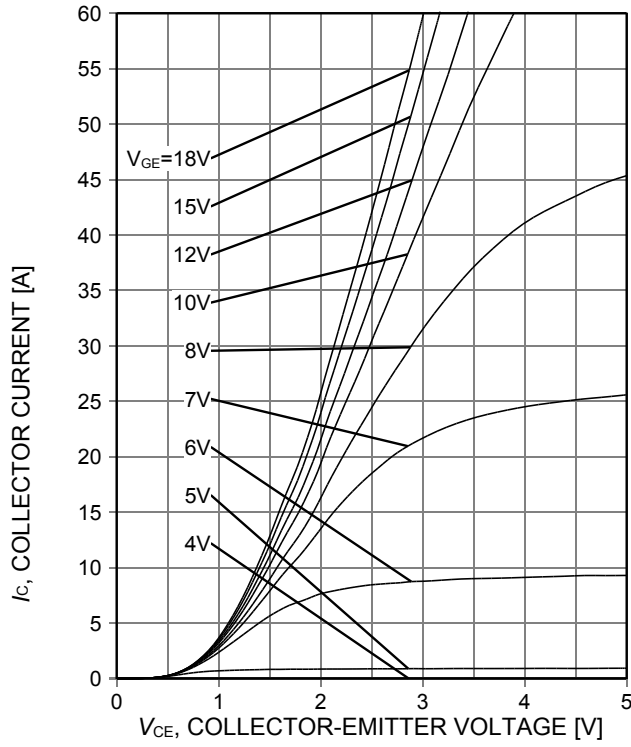


Figure 5. Typical output characteristic
($T_{vj}=150^{\circ}\text{C}$)

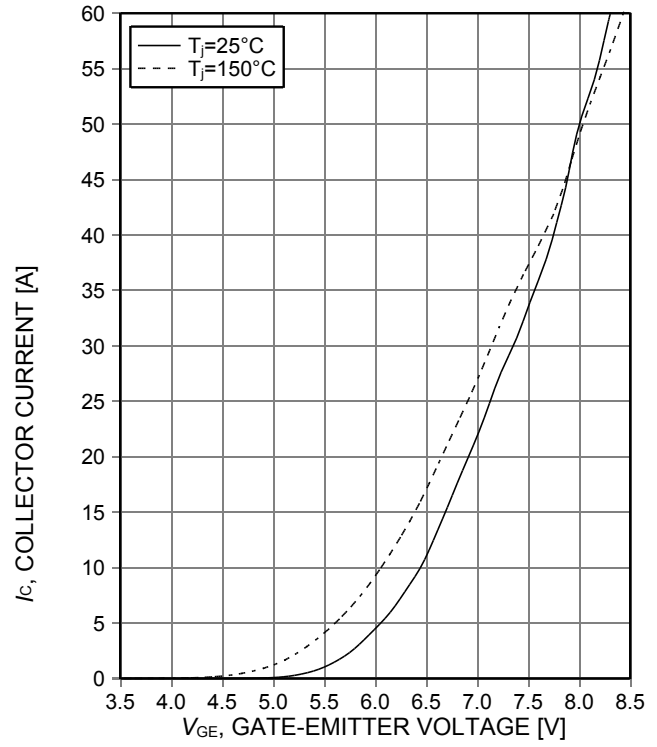


Figure 6. Typical transfer characteristic
($V_{ce}=20\text{V}$)

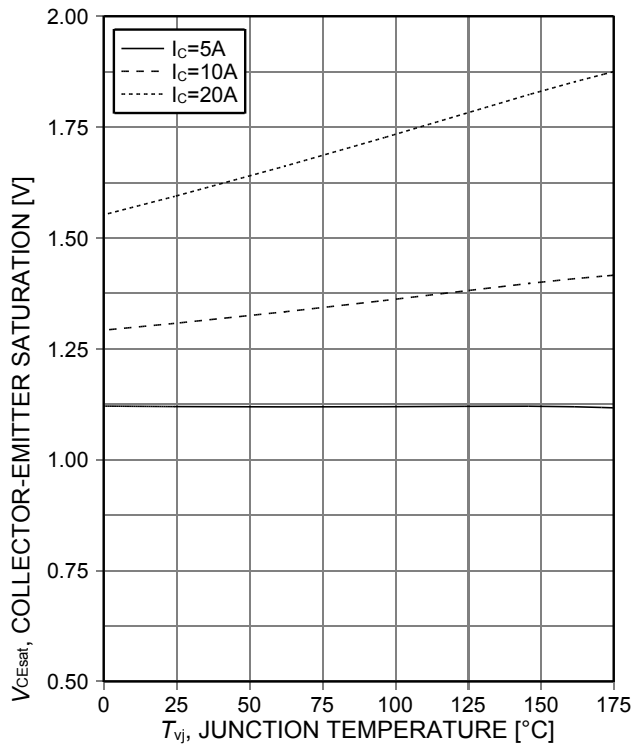


Figure 7. Typical collector-emitter saturation voltage as
a function of junction temperature

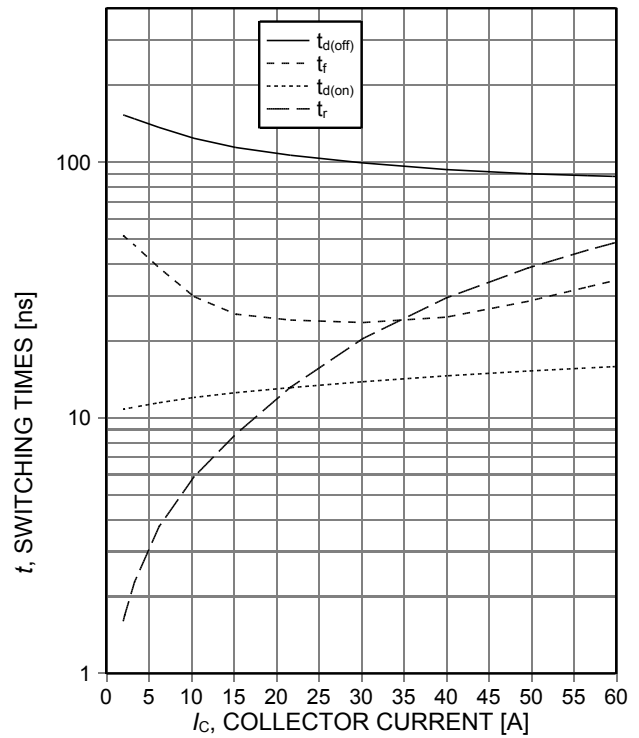


Figure 8. Typical switching times as a function of
collector current

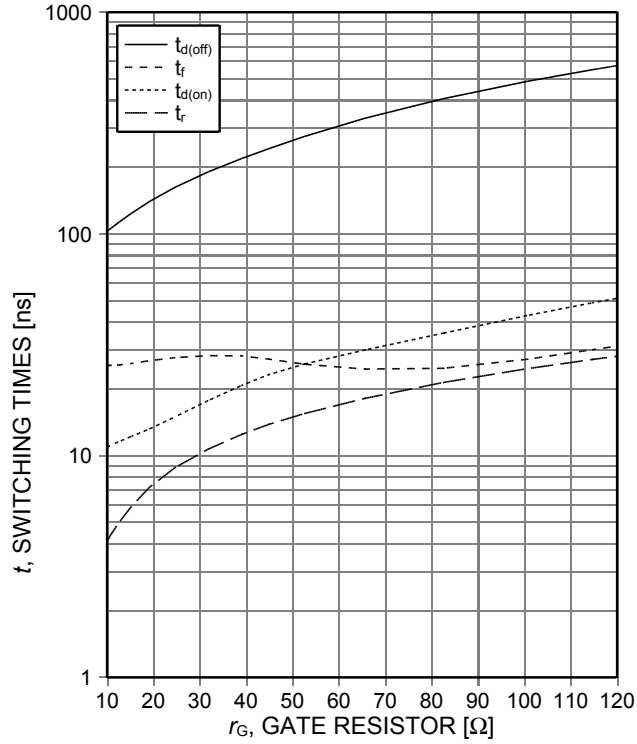


Figure 9. Typical switching times as a function of gate resistor

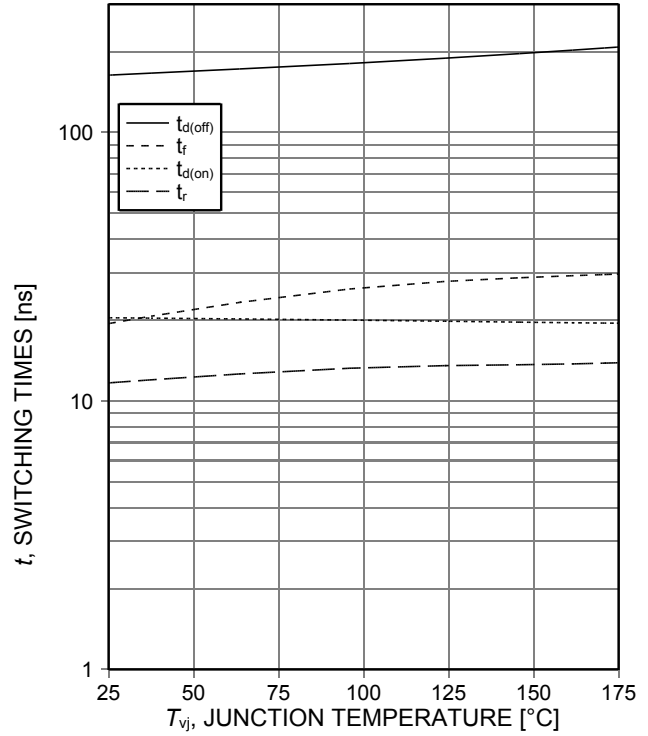


Figure 10. Typical switching times as a function of junction temperature

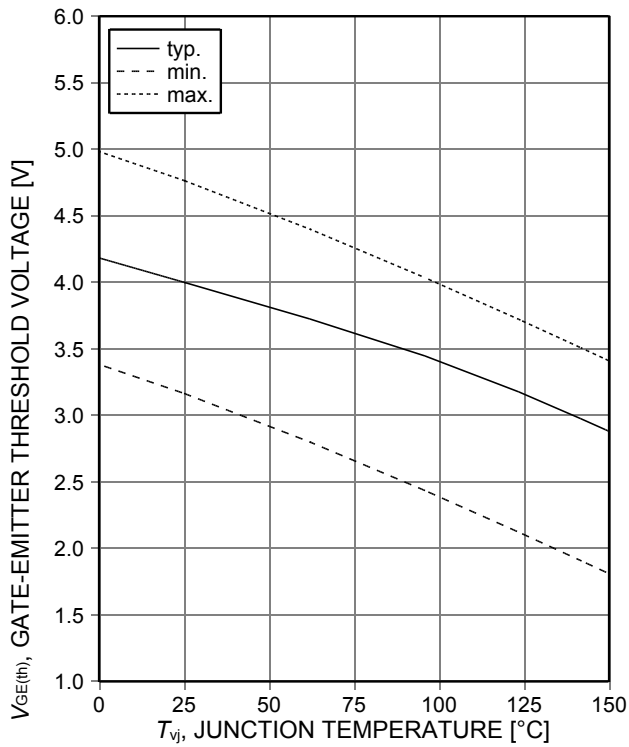


Figure 11. Gate-emitter threshold voltage as a function of junction temperature

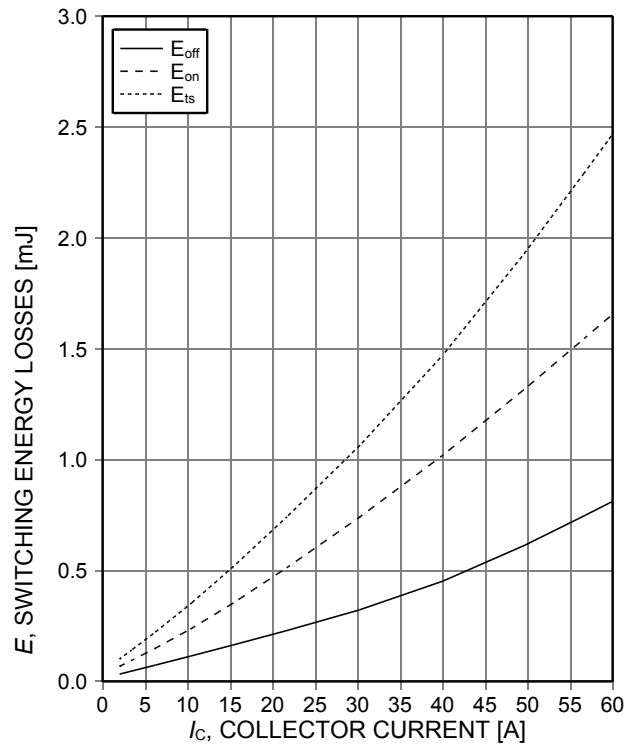


Figure 12. Typical switching energy losses as a function of collector current

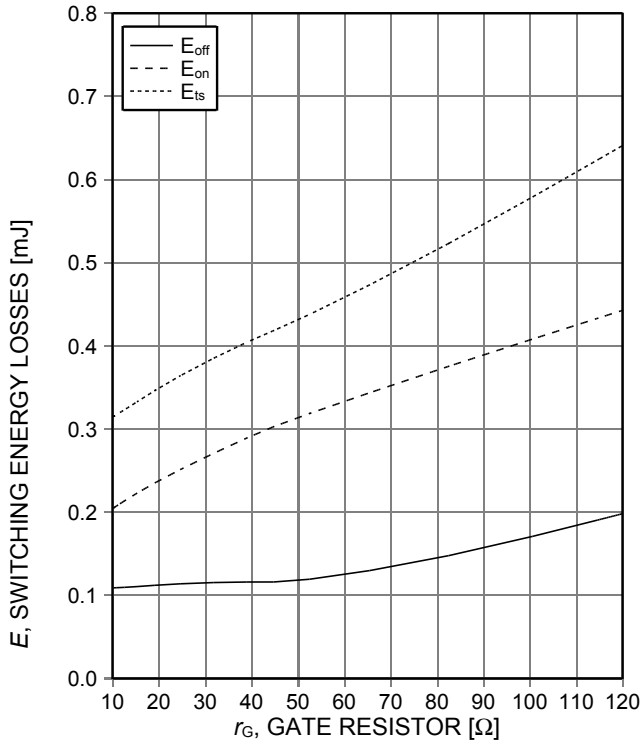


Figure 13. Typical switching energy losses as a function of gate resistor

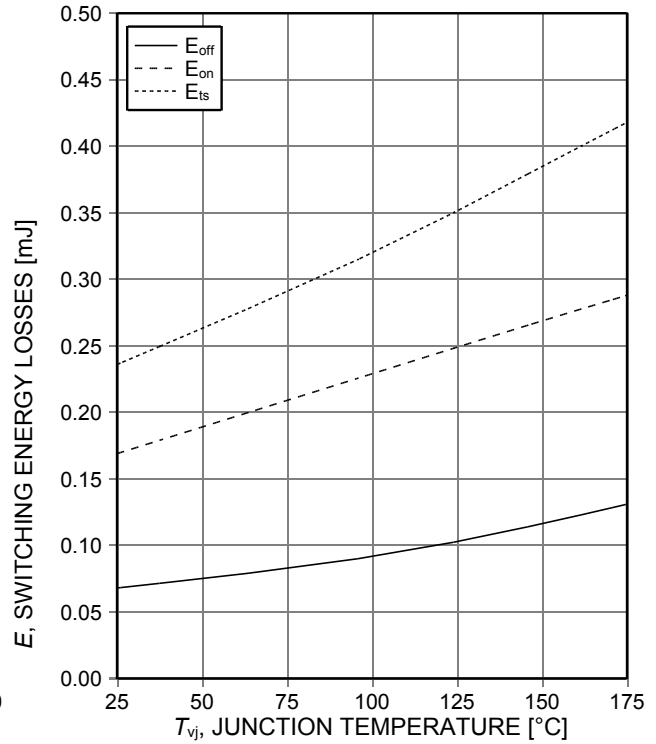


Figure 14. Typical switching energy losses as a function of junction temperature

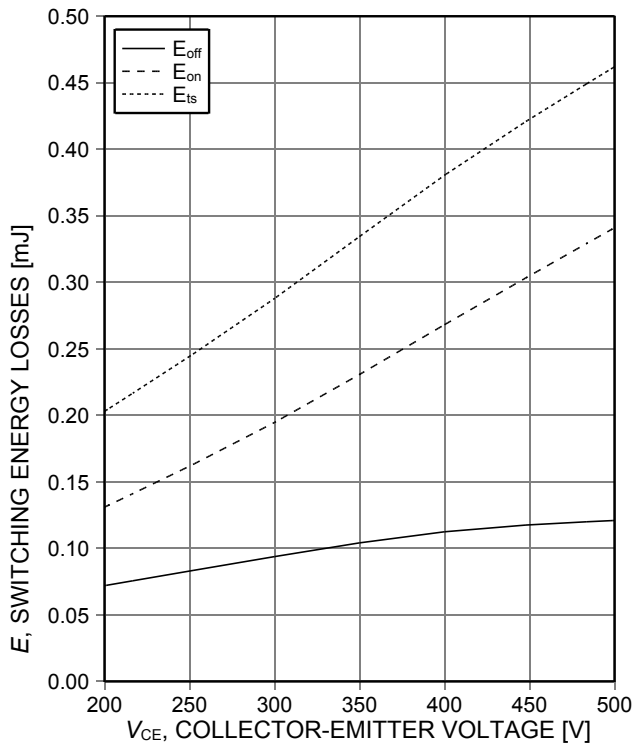


Figure 15. Typical switching energy losses as a function of collector emitter voltage

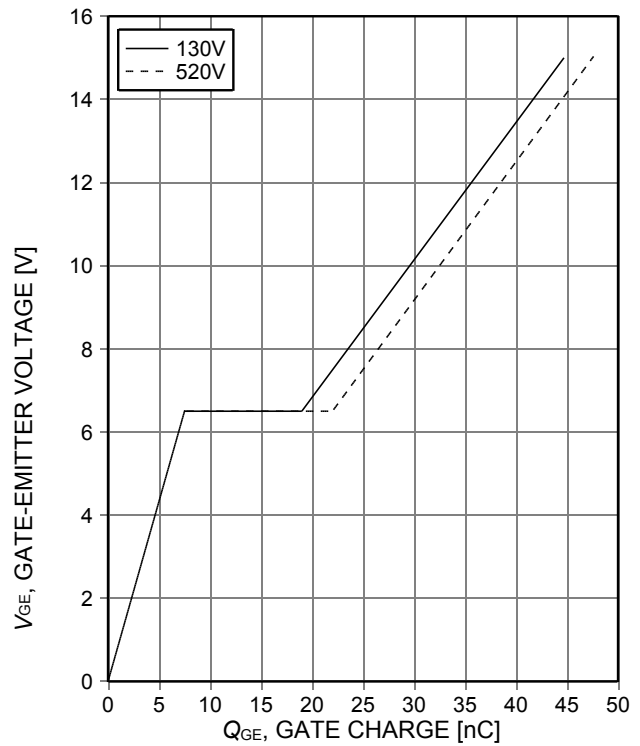


Figure 16. Typical gate charge

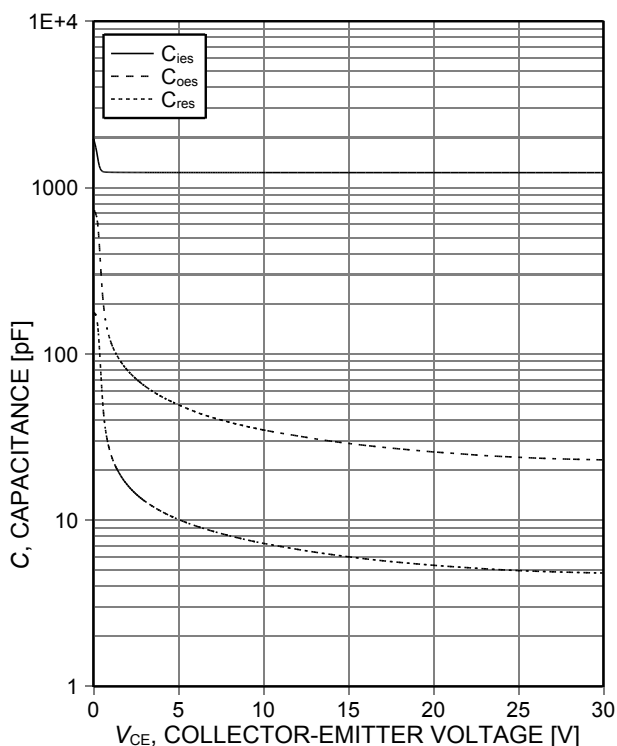


Figure 17. Typical capacitance as a function of collector-emitter voltage

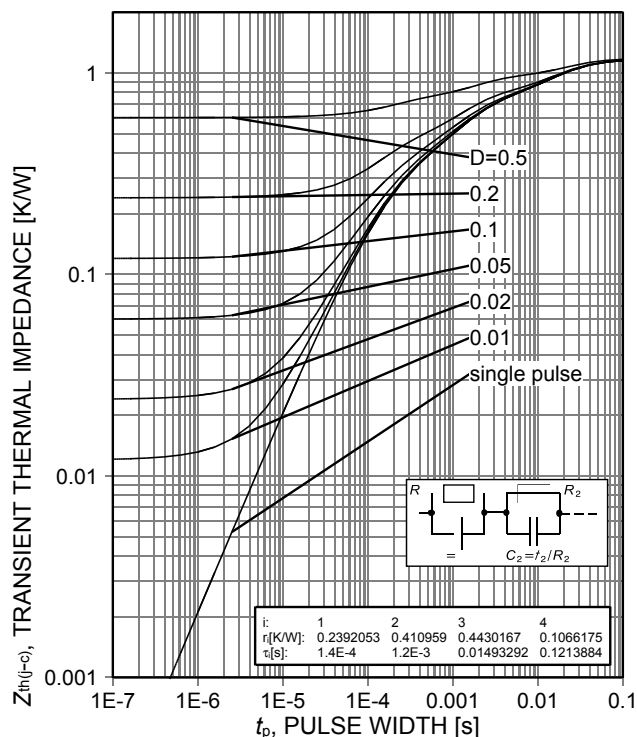


Figure 18. IGBT transient thermal impedance

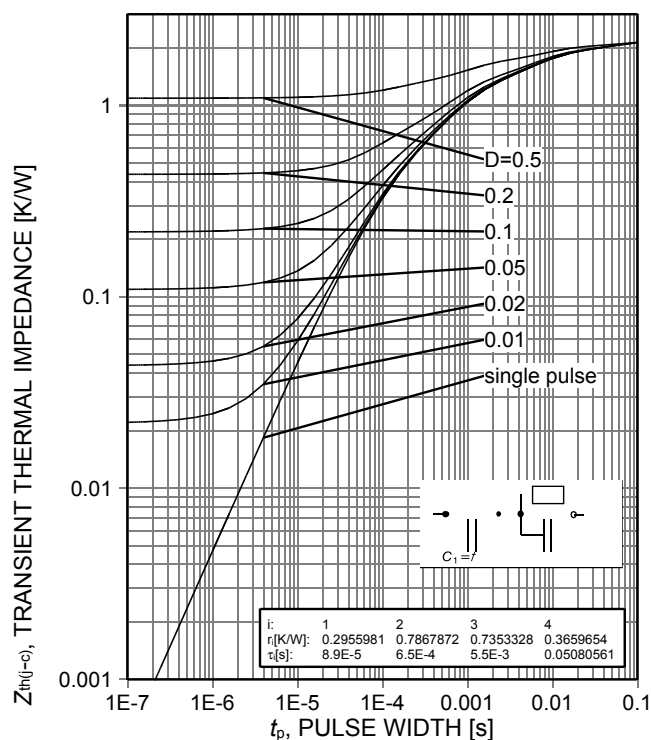


Figure 19. Diode transient thermal impedance as a function of pulse width

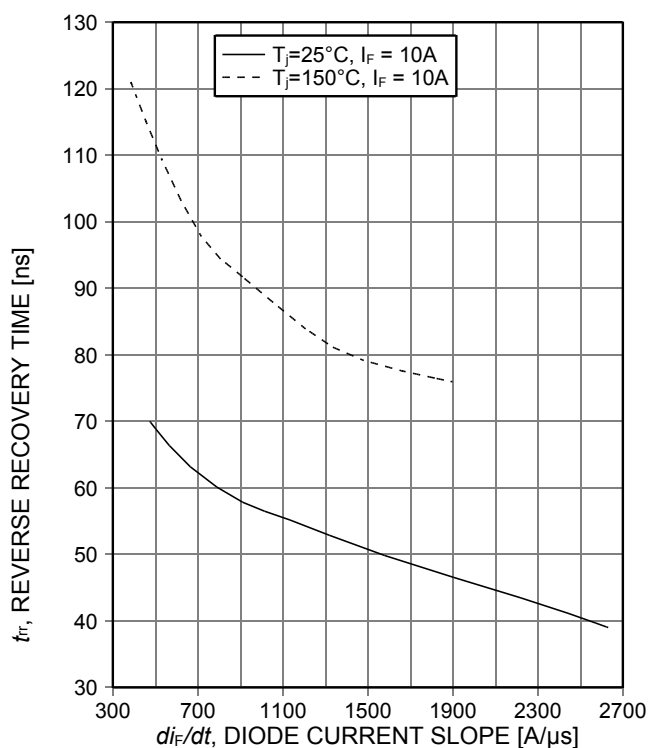
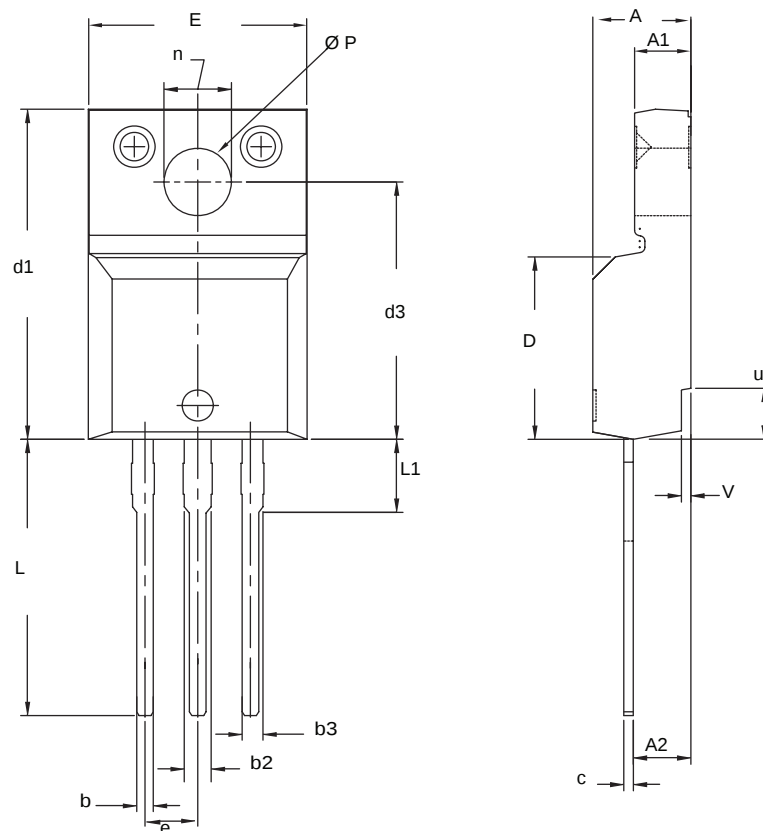


Figure 20. Typical reverse recovery time as a function of diode current slope

TO-220 FULLPAK (HIGH VOLTAGE)

DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.570	4.830	0.180	0.190
A1	2.570	2.830	0.101	0.111
A2	2.510	2.850	0.099	0.112
b	0.622	0.890	0.024	0.035
b2	1.229	1.400	0.048	0.055
b3	1.229	1.400	0.048	0.055
c	0.440	0.629	0.017	0.025
D	8.650	9.800	0.341	0.386
d1	15.88	16.120	0.622	0.635
d3	12.300	12.920	0.484	0.509
E	10.360	10.630	0.408	0.419
e	2.54 BSC		0.100 BSC	
L	13.200	13.730	0.520	0.541
L1	3.100	3.500	0.122	0.138
n	6.050	6.150	0.238	0.242
Ø P	3.050	3.450	0.120	0.136
u	2.400	2.500	0.094	0.098
v	0.400	0.500	0.016	0.020

ECN: X09-0126-Rev. B, DWG: 5972

Notes

1. To be used only for process drawing.
2. These dimensions apply to all TO-220, FULLPAK leadframe versions 3 leads.3
3. All critical dimensions should C meet $C_{pk} > 1.33$.
4. All dimensions include burrs and plating thickness.
5. No chipping or package damage.

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