

VBM16I20 Datasheet

600V Trench and Fieldstop IGBT

PRODUCT SUMMARY		
V_{CE} (V)	600	
I_C (A)	40 ($T_C=25^\circ\text{C}$)	20 ($T_C=100^\circ\text{C}$)
$V_{CE(sat)}$ (V)	1.8	
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

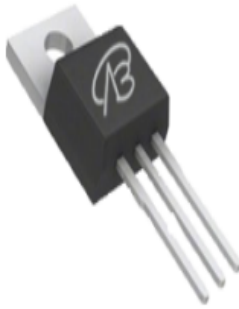
APPLICATIONS

- 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)

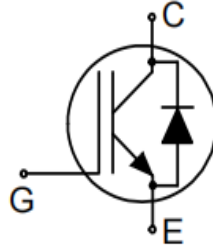
Package pin definition

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

TO-220



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		T _C = 25 °C	P _D	160	W
		T _C = 100 °C		40	W
Operating Junction and Storage Temperature Range			T _J , T _{stg}	-55 to +175	°C
Short Circuit Withstand Time ^{TC=150°C}	V _{GE} = 15V, V _{CE} ≤ 400V		t _{sc}	3	μs
Short Circuit Withstand Time ^{TC=100°C}	V _{GE} = 15V, V _{CE} ≤ 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 ($T_J = 25\text{ °C}$, unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Collector-Emitter Breakdown Voltage	BV_{CE}	$V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$ $V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$		600 600	- -	- -	V
Gate-Source Threshold Voltage (N)	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_D = 250\text{ }\mu\text{A}$		4	5	6	V
Zero Gate Voltage Collector Current	I_{CES}	$V_{CE} = 600\text{ V}, V_{GE} = 0\text{ V}, T_J = 25\text{ }^{\circ}\text{C}$		-	1	20	μA
		$V_{CE} = 600\text{ V}, V_{GE} = 0\text{ V}, T_J = 150\text{ }^{\circ}\text{C}$		-	1000	-	μA
Gate-Emitter Leakage Current	I_{GES}	$V_{CE} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$		-	-	100	nA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE} = 15\text{ V}$	$I_C = 20\text{ A}$	-	1.7	2.1	V
Forward Transconductance	g_{fs}	$V_{CE} = 20\text{ V}, I_C = 20\text{ A}$		-	18	-	S
Dynamic							
Input Capacitance	C_{ies}	$V_{GE} = 0\text{ V}, V_{CE} = 25\text{ V},$ $f = 500\text{ KHz}$		-	2200	-	pF
Output Capacitance	C_{oes}			-	91	-	
Reverse Transfer Capacitance	C_{res}			-	32	-	
Turn-on Energy	E_{on}	$V_{CE} = 400\text{ V}, V_{GE} = 0/15\text{V},$ $I_C = 20\text{ A}, R_g = 10\Omega$		-	0.55	-	nJ
Turn-off Energy	E_{off}			-	0.39	-	
Total Gate Charge	Q_g	$V_{GE} = 15\text{ V}$	$I_C = 20\text{ A}, V_{CE} = 400\text{ V}$	-	76	-	nC
Gate-Emitter Charge	Q_{ge}			-	21	-	
Gate to Collector Charge	Q_{gc}			-	30	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{CE} = 400\text{ V}, V_{GE} = 0/15\text{V},$ $I_C = 20\text{ A}, R_g = 10\Omega$		-	21	-	ns
Rise Time	t_r			-	38	-	
Turn-Off Delay Time	$t_{d(off)}$			-	175	-	
Fall Time	t_f			-	42	-	
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	$I_F = 20\text{ A}$		-	1.65	2.0	V
Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^{\circ}\text{C}, I_F = 20\text{ A},$ $dI_F/dt = 200\text{ A}/\mu\text{s}, V_R = 400\text{ V}$		-	70	-	ns
Reverse Recovery Charge	Q_{rr}			-	0.48	-	μC
Reverse Recovery Current	I_{RRM}			-	8	-	A

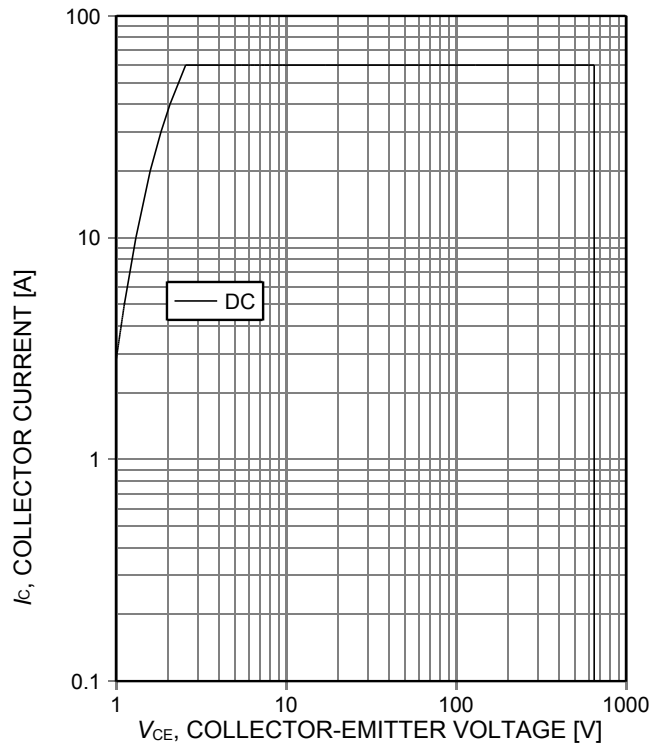


Figure 1. **Forward bias safe operating area**
 $(D=0, T_C=25^{\circ}\text{C}, T_{vj}\leq 175^{\circ}\text{C}; V_{GE}=15\text{V}.$
 Recommended use at $V_{GE}\geq 7.5\text{V}$)

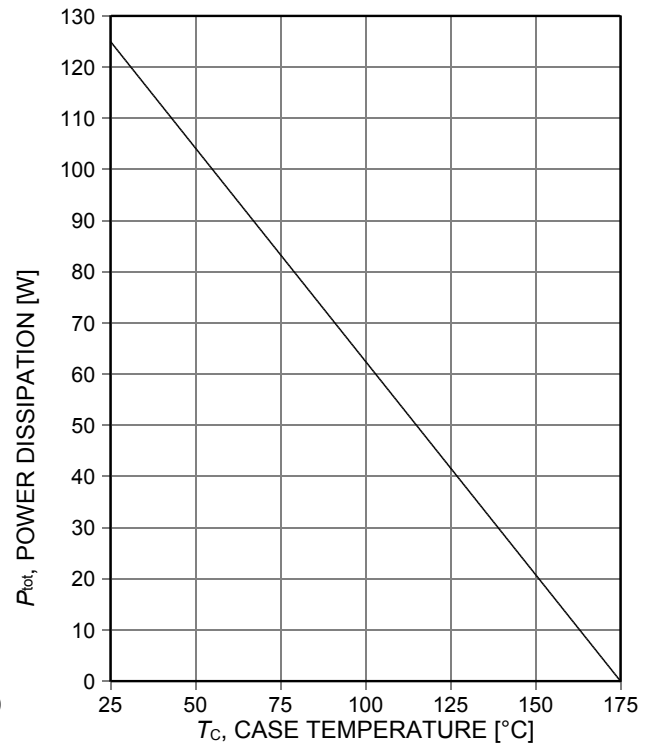


Figure 2. **Power dissipation as a function of case temperature**
 $(T_{vj}\leq 175^{\circ}\text{C})$

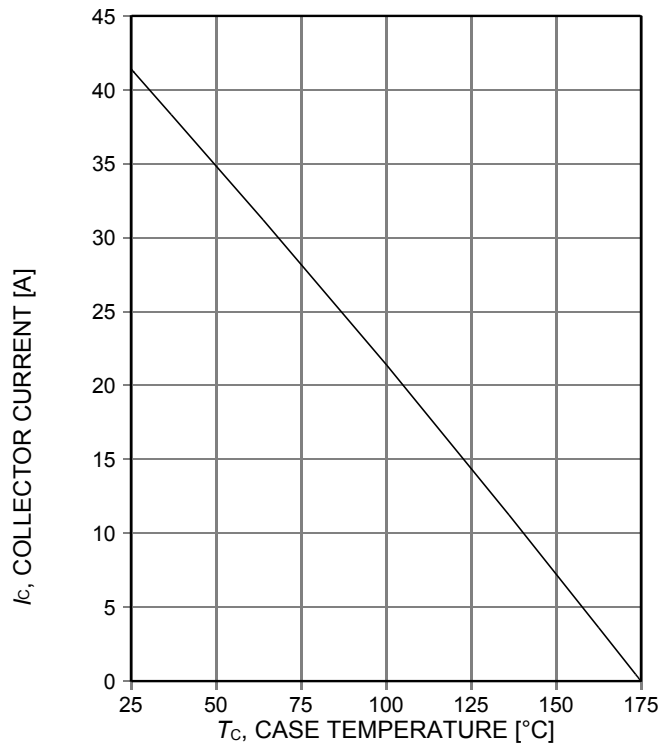


Figure 3. **Collector current as a function of case temperature**

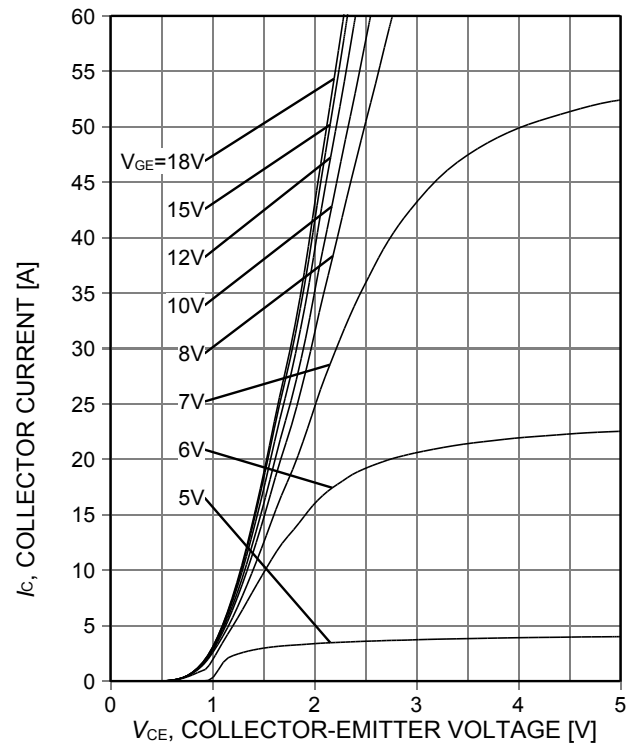


Figure 4. **Typical output characteristic**

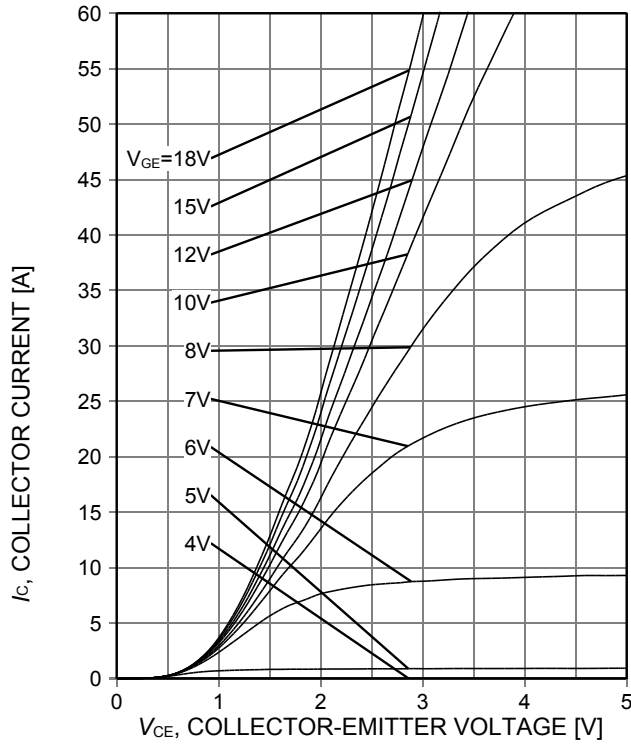


Figure 5. Typical output characteristic
($T_{vj}=150^{\circ}\text{C}$)

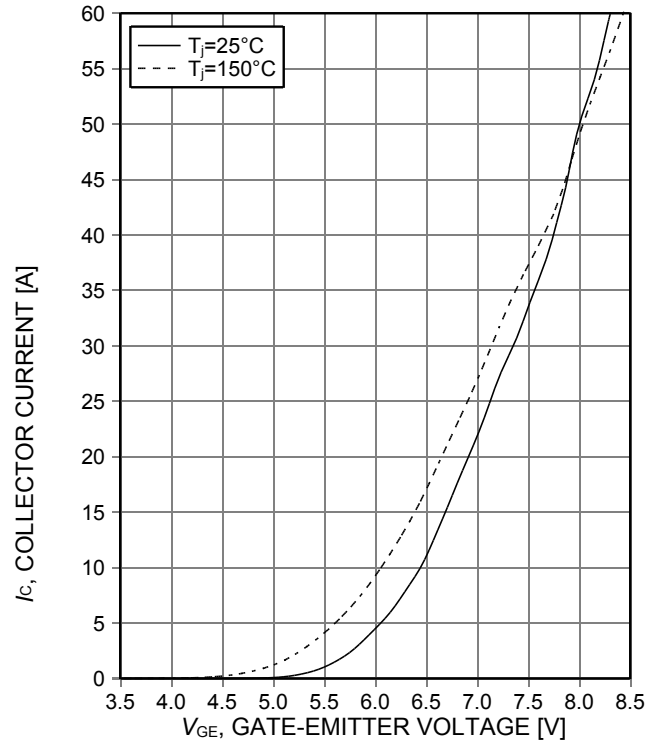


Figure 6. Typical transfer characteristic
($V_{ce}=20\text{V}$)

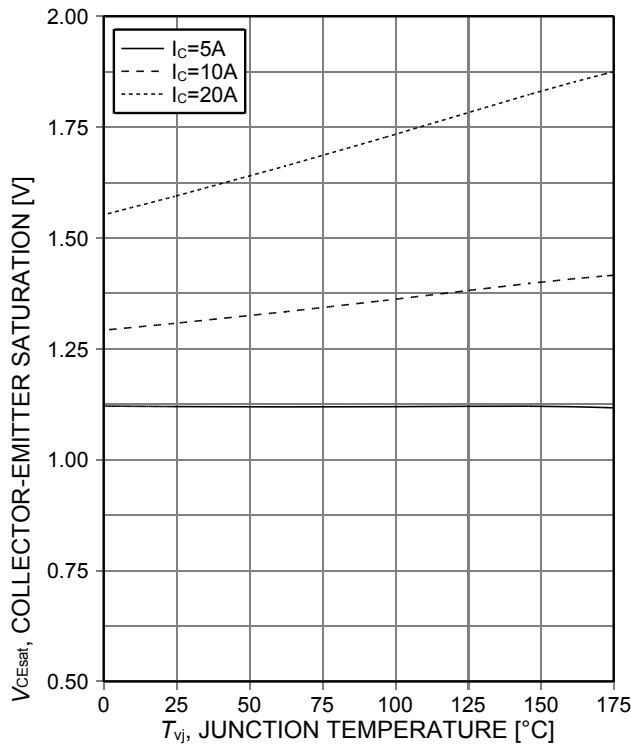


Figure 7. Typical collector-emitter saturation voltage as
a function of junction temperature

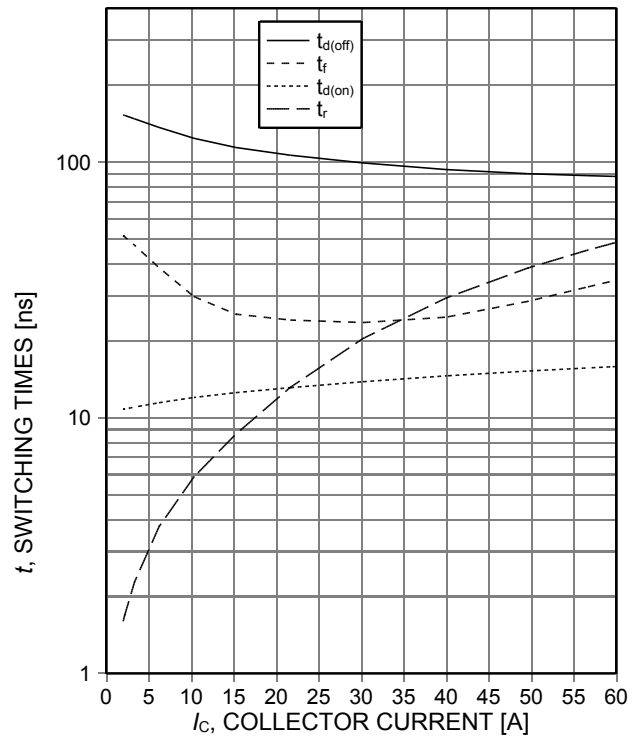


Figure 8. Typical switching times as a function of
collector current

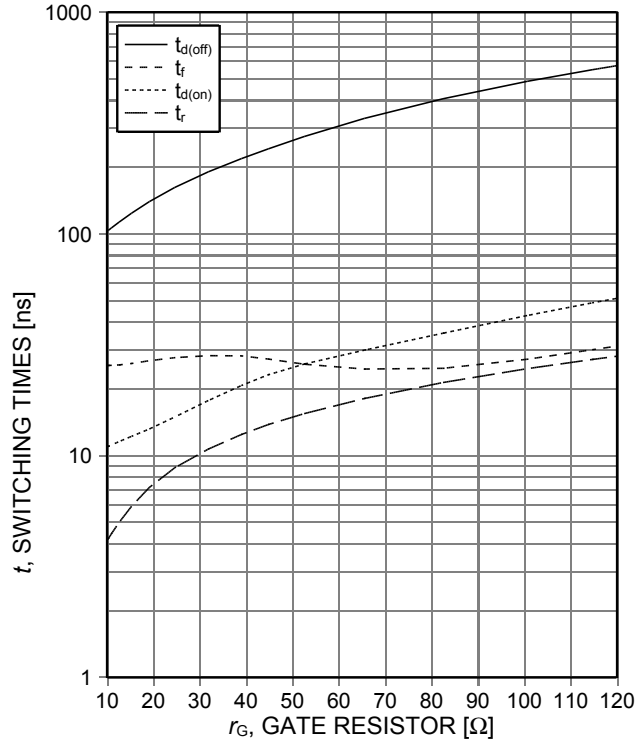


Figure 9. Typical switching times as a function of gate resistor

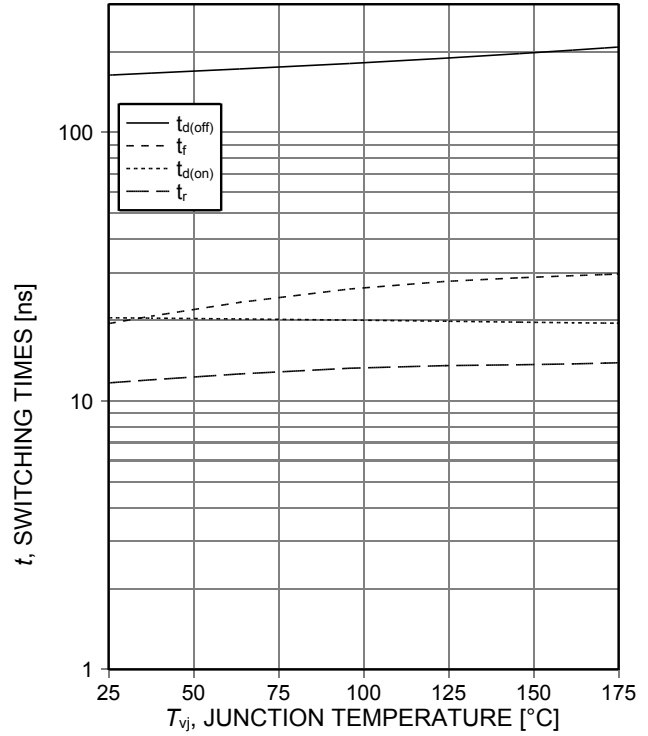


Figure 10. Typical switching times as a function of junction temperature

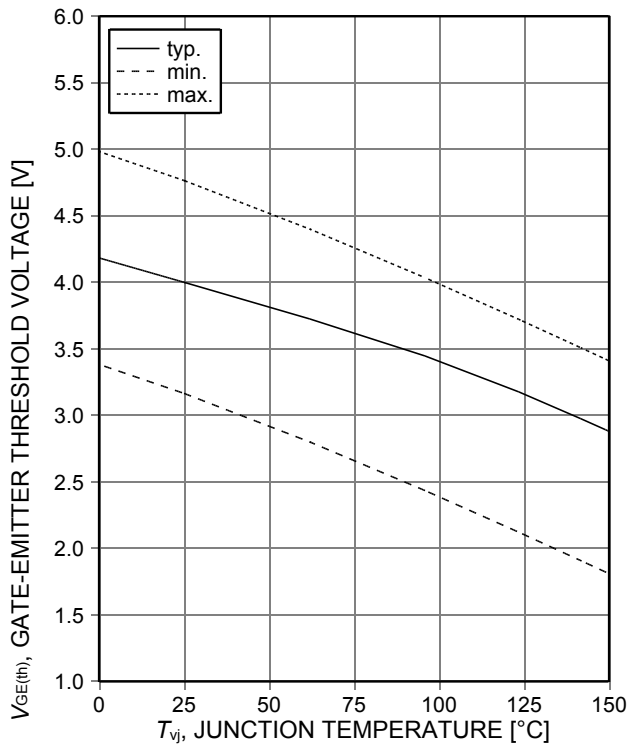


Figure 11. Gate-emitter threshold voltage as a function of junction temperature

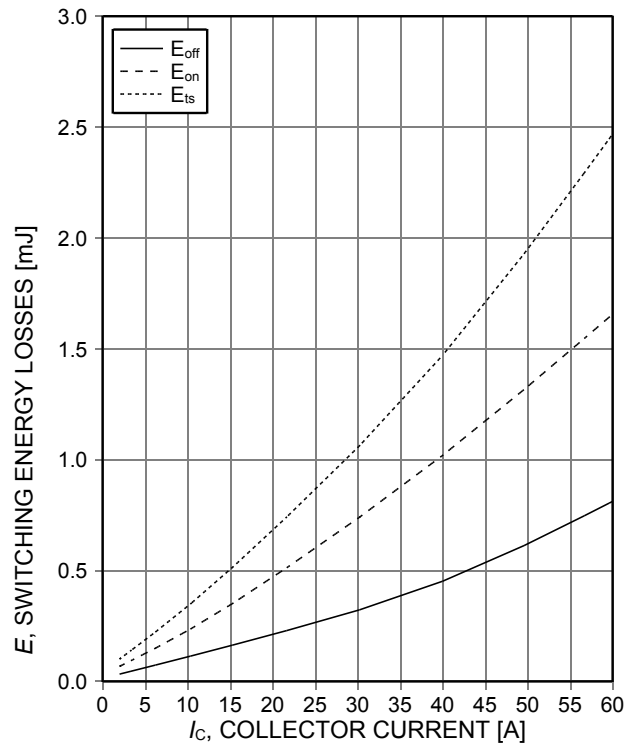


Figure 12. Typical switching energy losses as a function of collector current

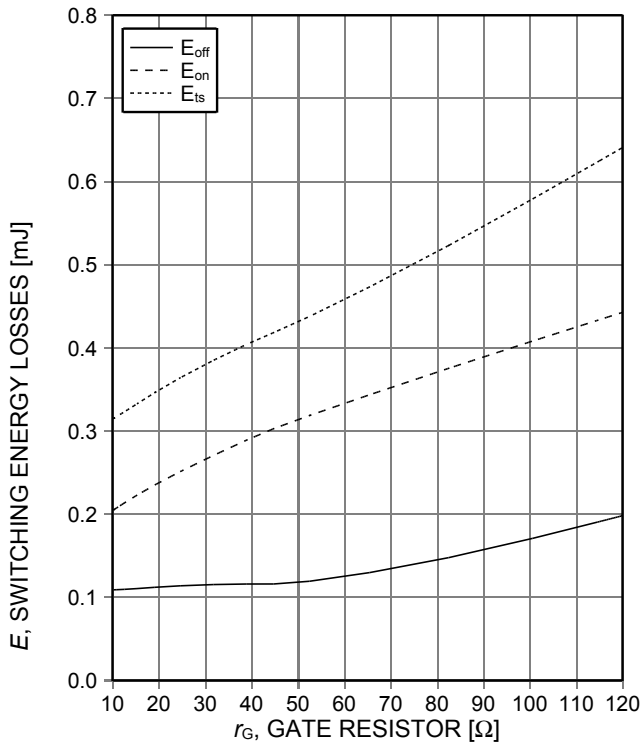


Figure 13. Typical switching energy losses as a function of gate resistor

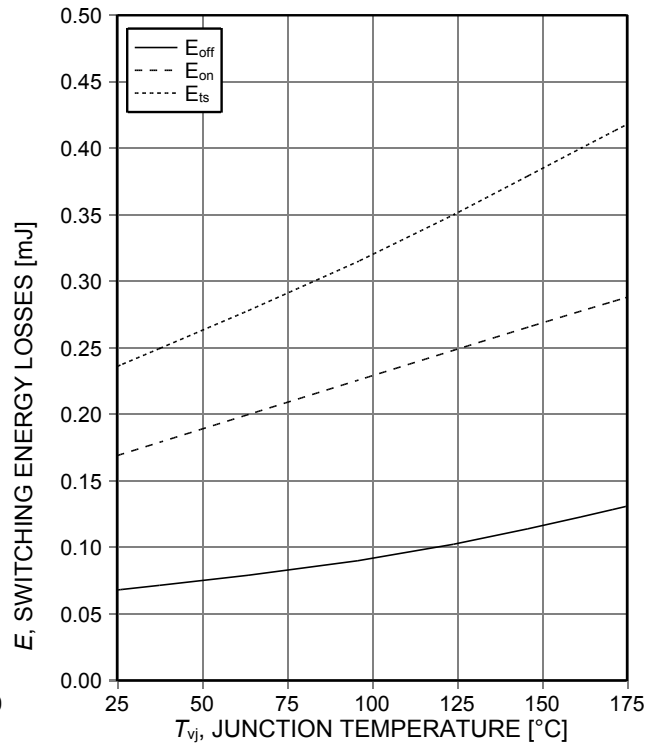


Figure 14. Typical switching energy losses as a function of junction temperature

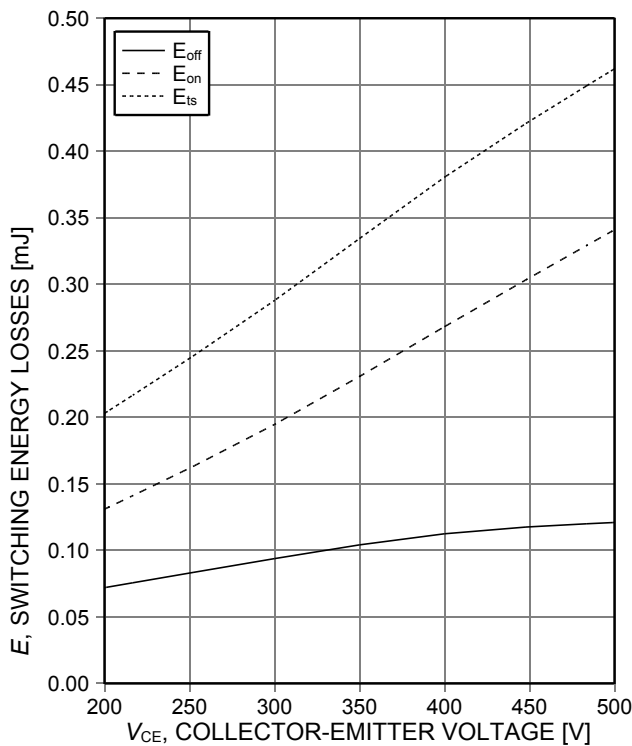


Figure 15. Typical switching energy losses as a function of collector emitter voltage

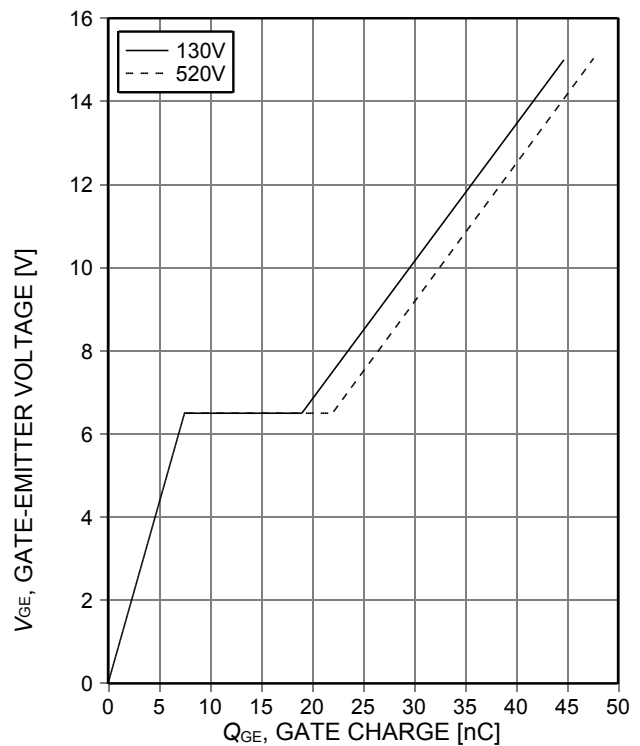


Figure 16. Typical gate charge

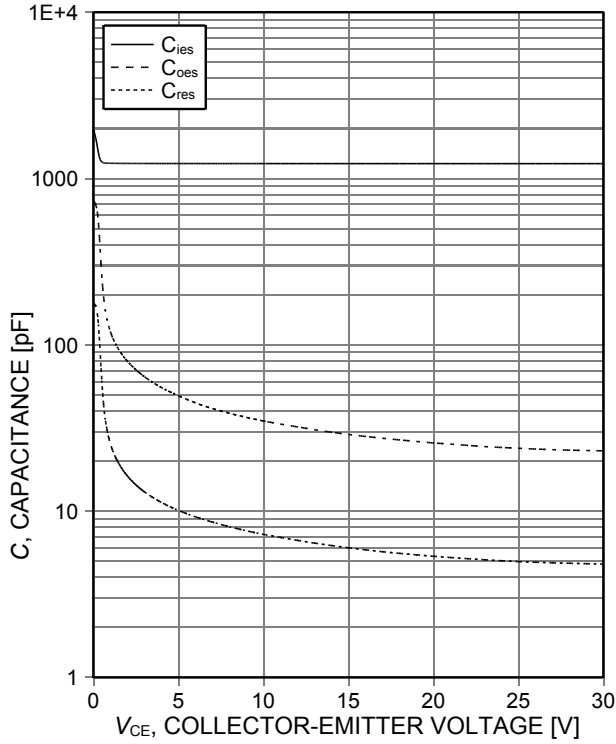


Figure 17. Typical capacitance as a function of collector-emitter voltage

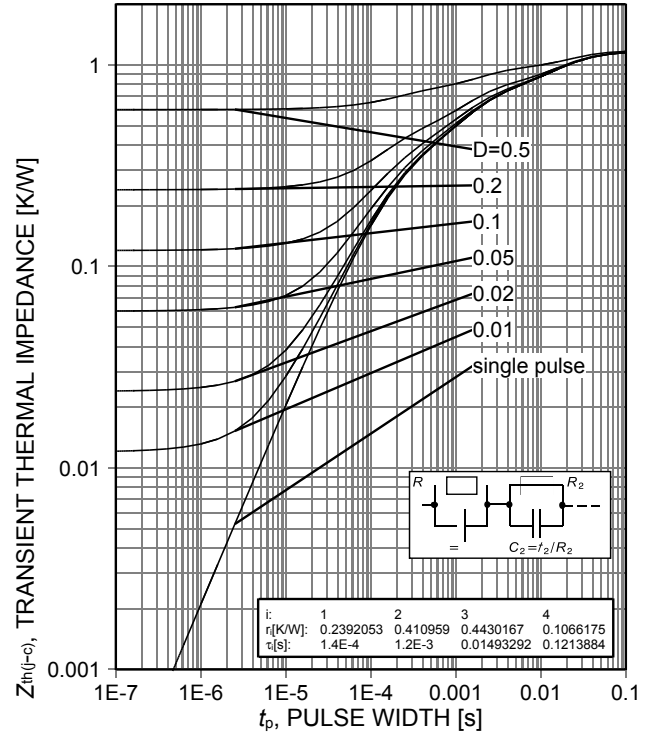


Figure 18. IGBT transient thermal impedance

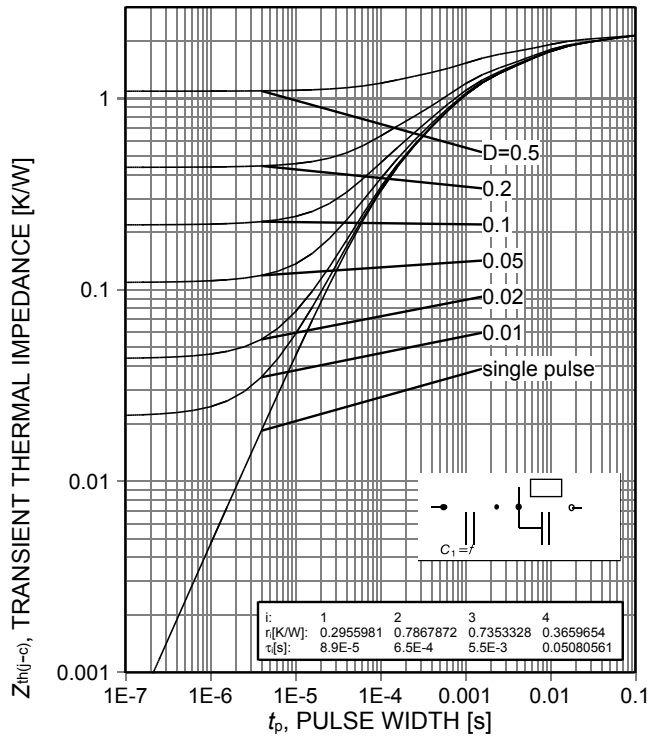


Figure 19. Diode transient thermal impedance as a function of pulse width

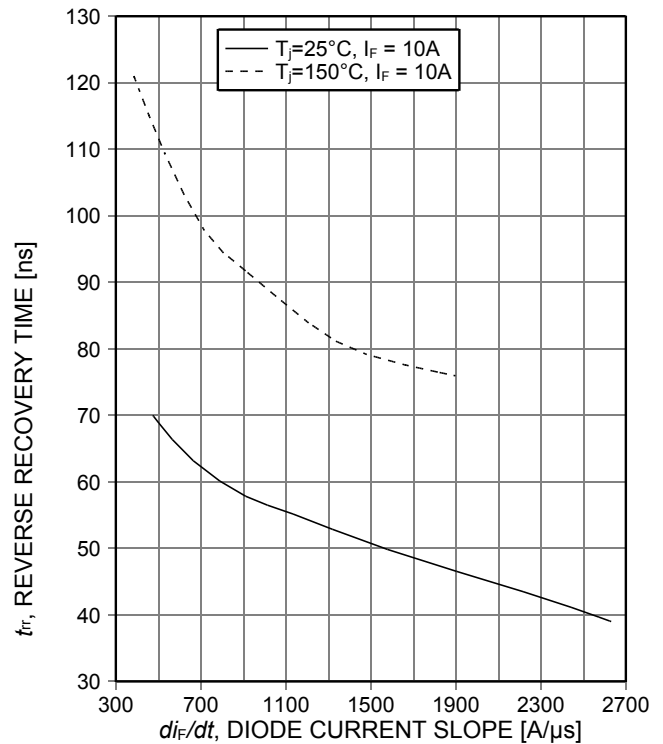
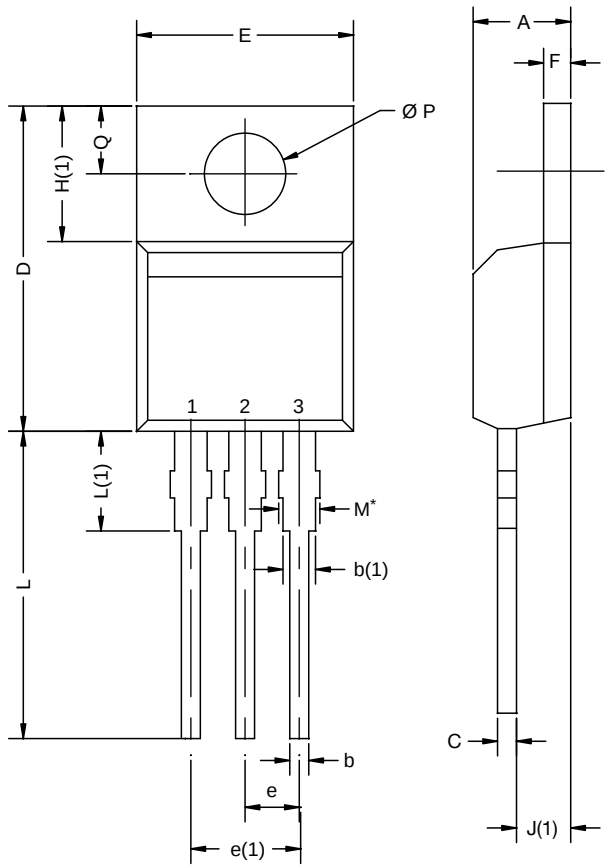


Figure 20. Typical reverse recovery time as a function of diode current slope

TO-220AB



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.25	4.65	0.167	0.183
b	0.69	1.01	0.027	0.040
b(1)	1.20	1.73	0.047	0.068
c	0.36	0.61	0.014	0.024
D	14.85	15.49	0.585	0.610
E	10.04	10.51	0.395	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.09	6.48	0.240	0.255
J(1)	2.41	2.92	0.095	0.115
L	13.35	14.02	0.526	0.552
L(1)	3.32	3.82	0.131	0.150
Ø P	3.54	3.94	0.139	0.155
Q	2.60	3.00	0.102	0.118

ECN: X12-0208-Rev. N, 08-Oct-12
DWG: 5471

Notes

* M = 1.32 mm to 1.62 mm (dimension including protrusion)
Heatsink hole for HVM

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