

Product Summary

$V_{(BR)CES}$	$V_{CE(SAT)MAX}$	$I_C(100^{\circ}C)$
650V	1.9V@15V	40A

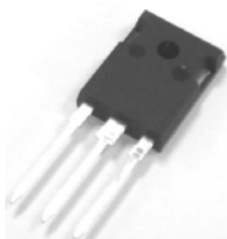
Feature

- Trench FSII Technology offering
- High speed switching
- Very tight parameter distribution
- High ruggedness, temperature stable behavior

Application

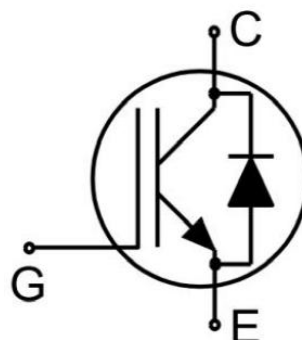
- Air Condition
- Inverters
- Motor drives

Package



TO-247AB

Circuit diagram



Marking



Absolute maximum ratings (Tc=25°C unless otherwise noted)

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CES}	650	V
Continuous Gate- Emitter Voltage	V_{GES}	± 30	V
Collector Current	I_C	80	A
Collector Current(T _C =100°C)	$I_{C(100^\circ C)}$	40	A
Pulsed Collector Current, t _p limited by T _{jmax}	I_{Cpuls}	160	A
Turn off safe operating area, V _{CE} =650V, T _j =175°C	-	160	A
Diode Continuous Forward Current(T _C =100°C)	$I_F(100^\circ C)$	40	A
Diode Maximum Forward Current	I_{FM}	160	A
Power Dissipation	P_D	288	W
Thermal Resistance, Junction to case for IGBT	$R_{\theta JC}$	0.52	°C/W
Thermal Resistance, Junction to case for Diode	$R_{\theta JC}$	0.99	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	40	°C/W
Short circuit withstand time V _{GE} =15V, V _{CC} ≤400V, Allowed number of short circuits<1000Time between short circuits: ≥1.0s, T _j ≤150°C	t _{sc}	5	uS
Junction Temperature Range	T _J	175	°C
Storage Temperature Range	T _{STG}	-55 ~ +175	°C
Maximum Temperature for Soldering	T _L	260	°C

Electrical characteristics of the IGBT (T_C=25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Static Characteristics						
Collector-Emitter Breakdown Voltage	$V_{(BR)CES}$	V _{GE} = 0V, I _{CE} =1mA	650			V
Collector-Emitter Leakage Current	I _{CES}	V _{GE} = 0V, V _{CE} =650V			40	uA
Gate to Emitter Leakage Current	I _{GES}	V _{GE} =±30V, V _{CE} = 0V			200	nA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V _{GE} =15V, I _C =40A, T _j =25°C		1.7	1.9	V
		V _{GE} =15V, I _C =40A, T _j =175°C		1.9		
Gate Threshold Voltage	$V_{GE(th)}$	V _{CE} =V _{GE} , I _C =1mA	4	5	6	V
Dynamic characteristics						
Input Capacitance	C _{ies}	V _{CE} =25V, V _{GE} =0V, f =1MHz		4894		pF
Output Capacitance	C _{oes}			136		
Reverse Transfer Capacitance	C _{res}			94		
Total Gate Charge	Q _g	V _{CC} =480V, V _{GE} =15V, I _C =40A		176		nC
Gate to Emitter Charge	Q _{ge}			38		
Gate to Collector Charge	Q _{gc}			73		
Short circuit collector current Max.1000 short circuits Time between short circuits: ≥1.0s	I _{C(SC)}	V _{GE} =15V, V _{CC} ≤400V, t _{sc} ≤5us, T _j ≤150°C		235		A
Turn-on delay time	t _{d(ON)}	V _{CC} =400V, I _C =40A, V _{GE} =0/15V, R _g =5Ω, Inductive Load		19		nS
Turn-on rise time	t _r			17		
Turn-off delay time	t _{d(OFF)}			168		
Turn-off fall time	t _f			16		
Turn-On Switching Loss	E _{on}			0.58		mJ
Turn-Off Switching Loss	E _{off}			0.48		
Total Switching Loss	E _{ts}			1.06		
Turn-On Switching Loss	E _{on}	V _{CC} =400V, I _C =40A, V _{GE} =0/15V, R _g =5Ω, T _j =175°C		0.70		mJ
Turn-Off Switching Loss	E _{off}			0.65		
Total Switching Loss	E _{ts}			1.35		

Electrical characteristics of the Diode ($T_c=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Diode Forward Voltage	V_{FM}	$I_F=40\text{A}, T_j=25^\circ\text{C}$		1.75	2.40	V
		$I_F=40\text{A}, T_j=175^\circ\text{C}$		1.40		
Reverse Recovery Time	T_{rr}	$V_R=400\text{V}, I_F=40\text{A},$ $di/dt=200\text{A}/\mu\text{s}$		242		nS
Diode Peak Reverse Recovery Current	I_{RRM}			3.9		A
Reverse Recovery Charge	Q_{rr}			0.44		μC
Reverse Recovery Time	T_{rr}	$V_R=400\text{V}, I_F=40\text{A},$ $di/dt=200\text{A}/\mu\text{s}, T_j=175^\circ\text{C}$		452		nS
Diode Peak Reverse Recovery Current	I_{RRM}			5.5		A
Reverse Recovery Charge	Q_{rr}			1.21		μC

Typical Electrical and Thermal Characteristics

Figure 1 Output Characteristics

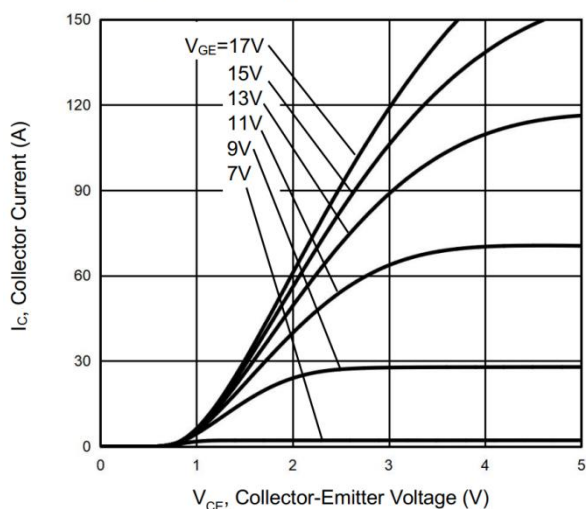


Figure 2 Output Characteristics

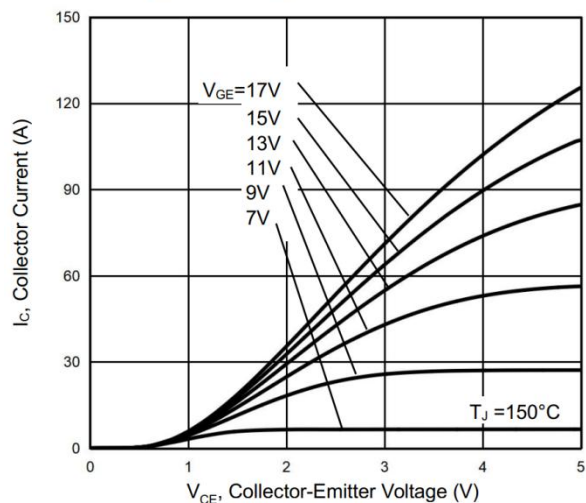


Figure 3 Transfer Characteristics

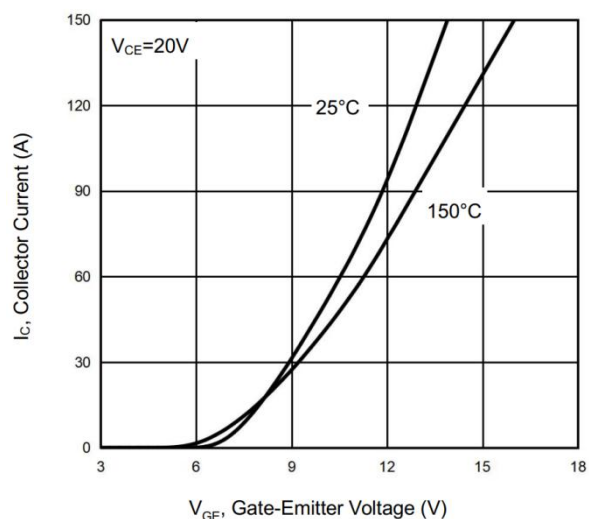


Figure 4 Saturation Voltage vs. V_{GE}

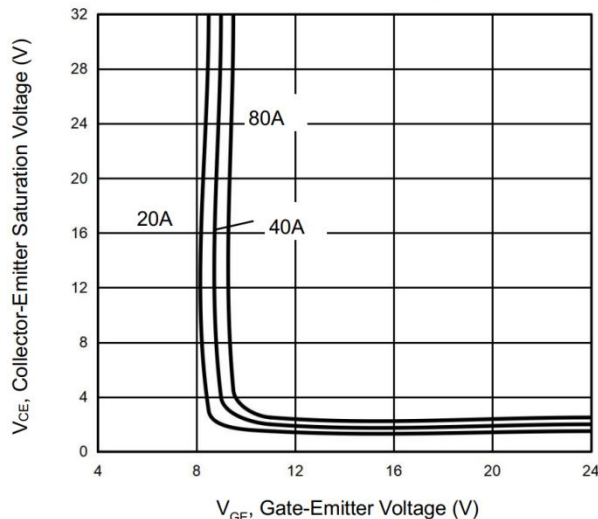


Figure 5 Capacitance Characteristics

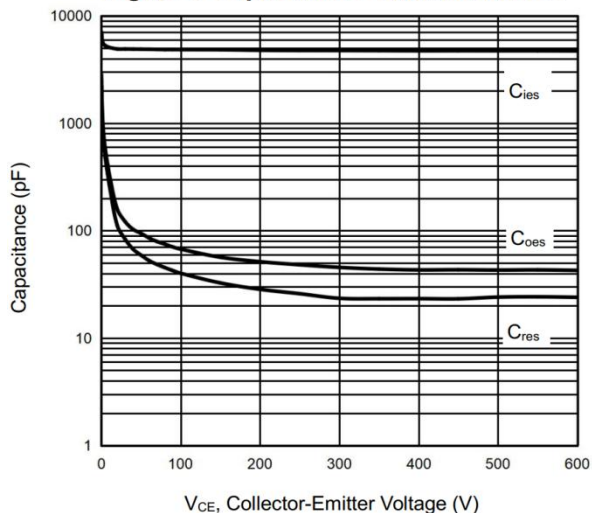
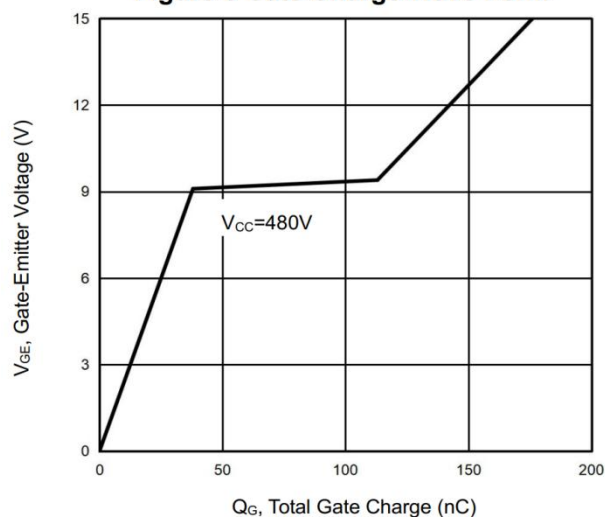


Figure 6 Gate Charge Wave Form



Typical Electrical and Thermal Characteristics

Figure 7 $V_{CE(sat)}$ vs. Case Temperature

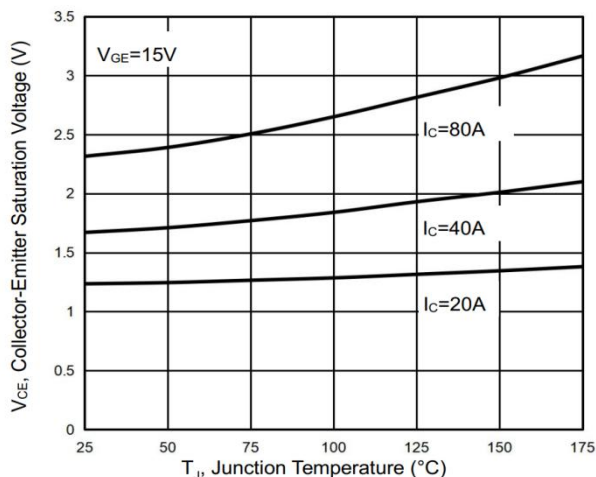


Figure 8 Typical Collector-Emitter Saturation Voltage as a function of Collector Current

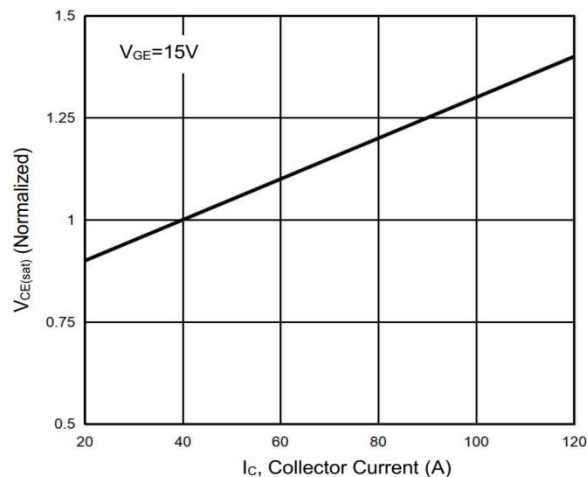


Figure 9 Forward Characteristics

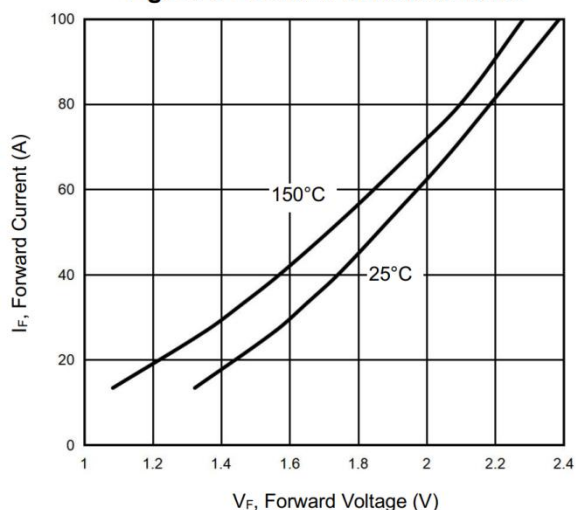


Figure 10 V_F vs. Temperature

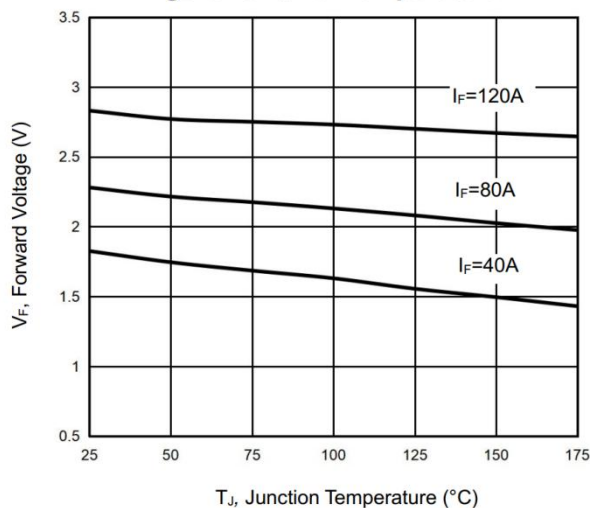


Figure 11 Switching Energy vs. Temperature

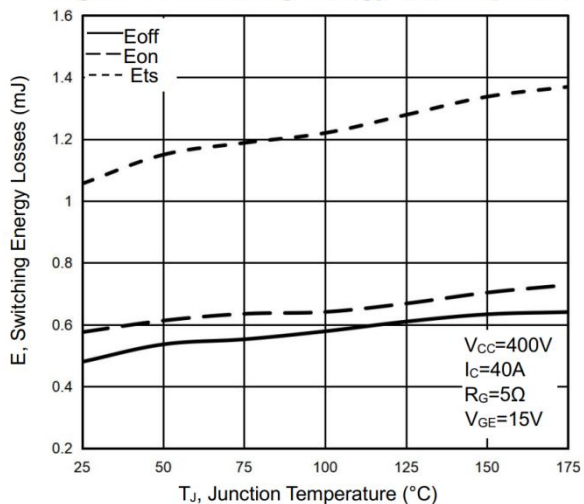
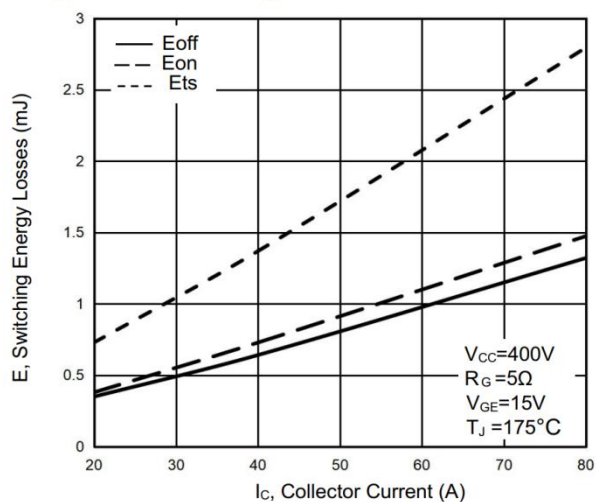


Figure 12 Switching Loss vs. Collector Current



Typical Electrical and Thermal Characteristics

Figure 13 Switching Loss vs. R_G

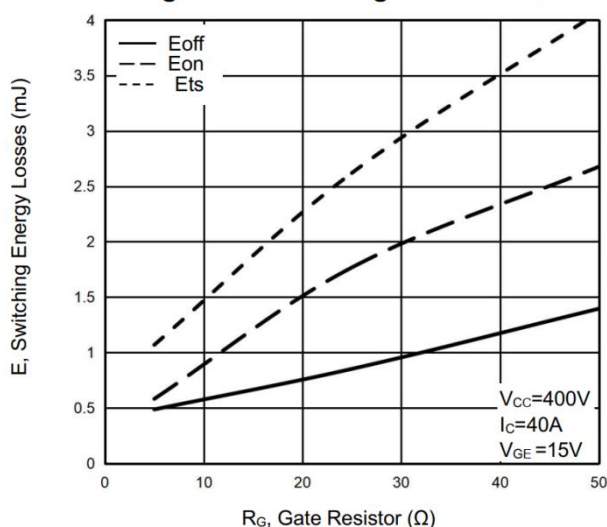


Figure 14 Switching Loss vs. Collector Current

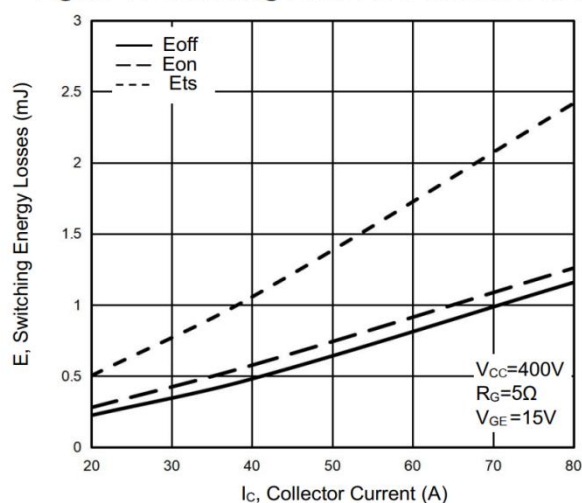


Figure 15 Forward Bias Safe Operating Area

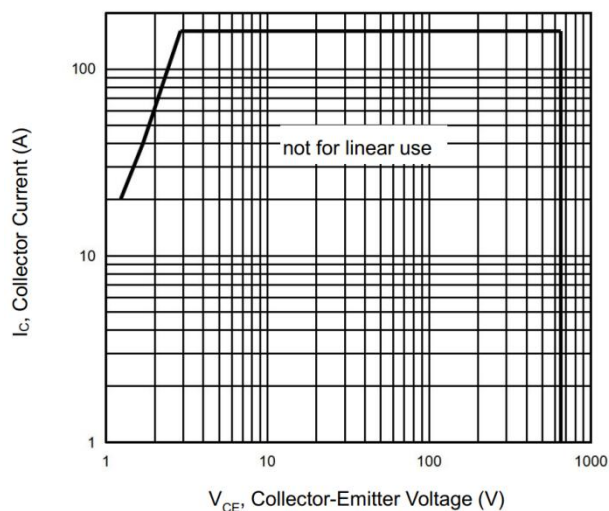


Figure 16 P_D vs. Case Temperature

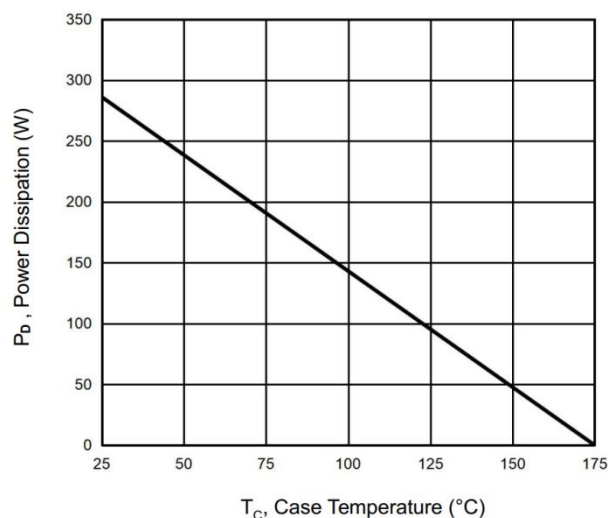


Figure 17 V_{CES} vs. Case Temperature

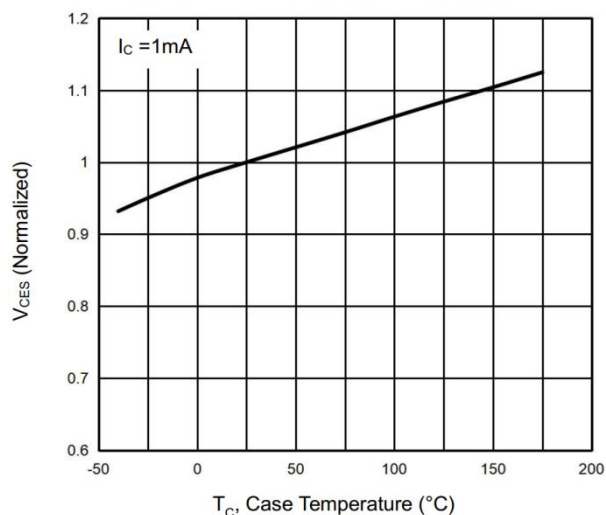
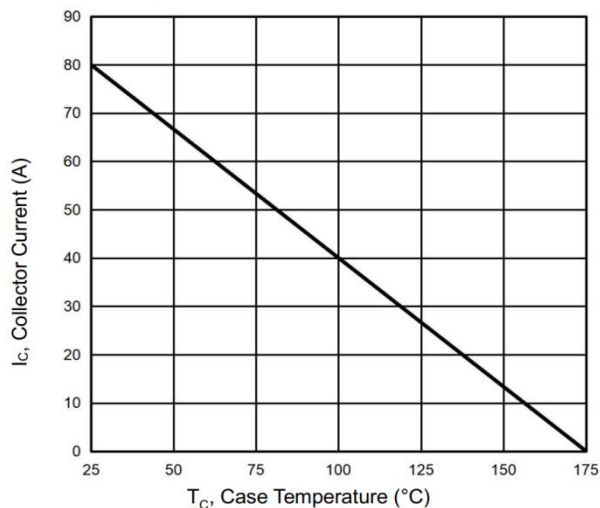


Figure 18 I_C vs. Temperature



Typical Electrical and Thermal Characteristics

Figure 19 Switching Time vs. I_C

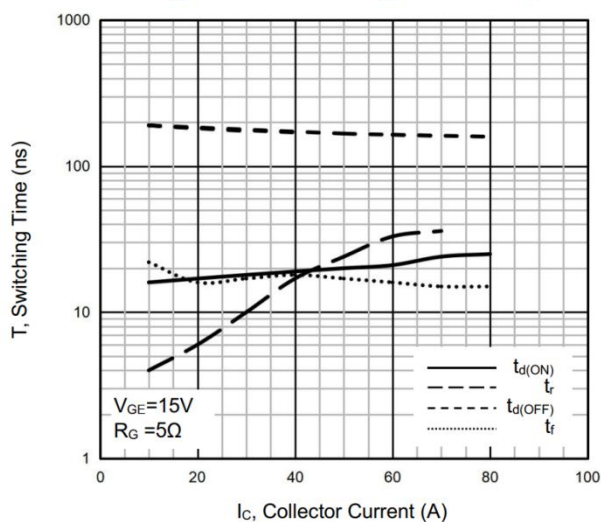


Figure 20 Switching Time vs. R_G

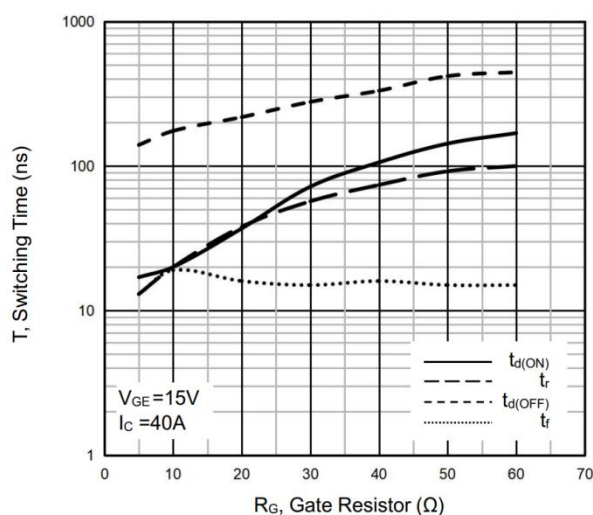


Figure 21 Switching Time vs. I_C

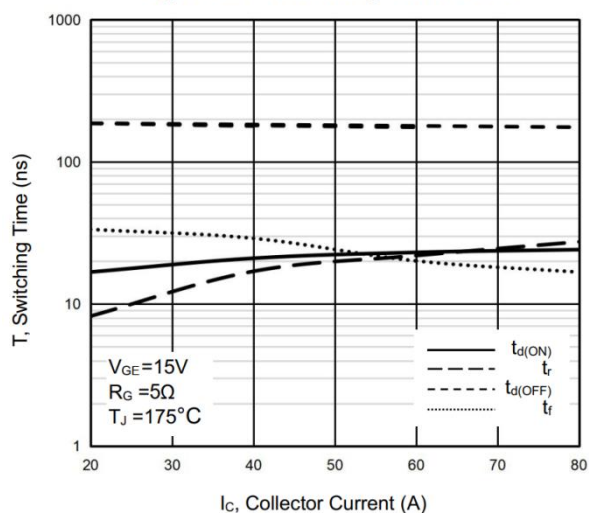


Figure 22 Switching Time vs. R_G

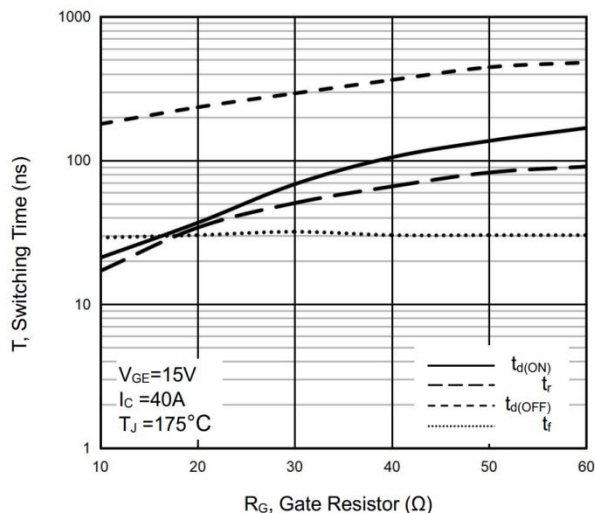


Figure 23 $V_{CE(sat)}$ vs. Collector Current

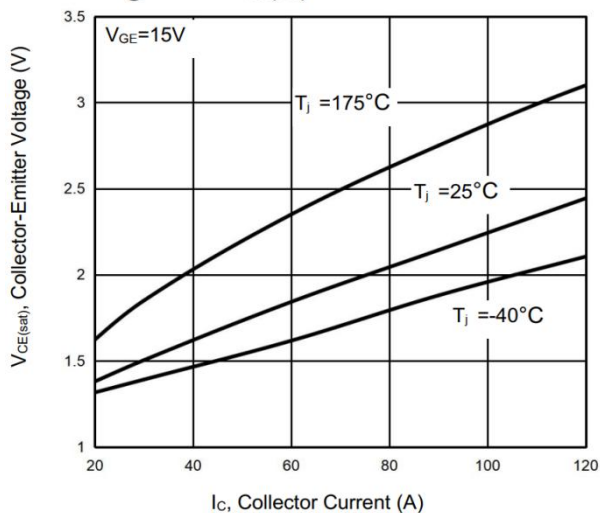
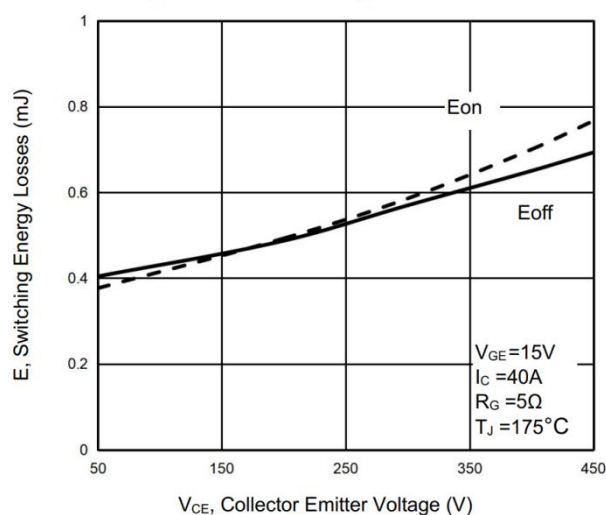
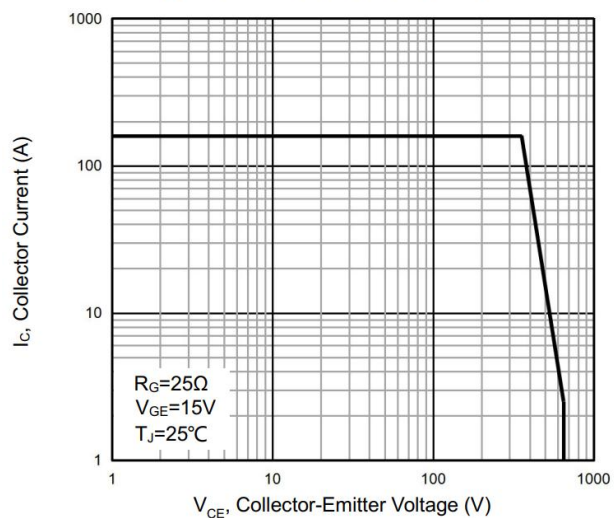


Figure 24 Switching Loss vs. V_{CE}

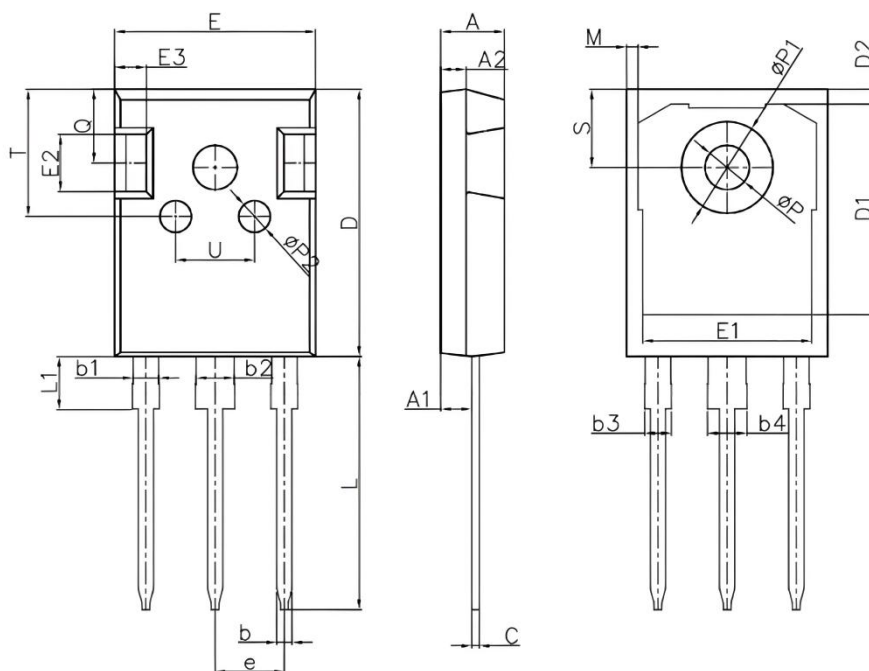


Typical Electrical and Thermal Characteristics

Figure 25 Reverse Bias SOA



TO-247AB Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.900	5.100	0.193	0.201
A1	2.310	2.510	0.091	0.099
A2	1.900	2.100	0.075	0.083
b	1.160	1.260	0.046	0.050
b1	1.960	2.060	0.077	0.081
b2	2.960	3.060	0.117	0.120
b3	-	2.250	-	0.089
b4	-	3.250	-	0.128
C	0.590	0.660	0.023	0.026
D	20.900	21.100	0.823	0.831
D1	16.250	16.850	0.640	0.663
D2	1.050	1.350	0.041	0.053
E	15.700	15.900	0.618	0.626
E1	13.100	13.500	0.516	0.531
E2	4.400	4.600	0.173	0.181
E3	2.400	2.600	0.094	0.102
e	5.436 BSC.		0.214 BSC.	
L	19.800	20.100	0.780	0.791
L1	-	4.300	-	0.169
M	0.350	0.950	0.014	0.037
ØP	3.400	3.600	0.134	0.142
ØP1	7.000	7.400	0.276	0.291
ØP2	2.400	2.600	0.094	0.102
Q	5.600	6.000	0.220	0.236
S	6.050	6.250	0.238	0.246
T	9.800	10.200	0.386	0.402
U	6.000	6.400	0.236	0.252