

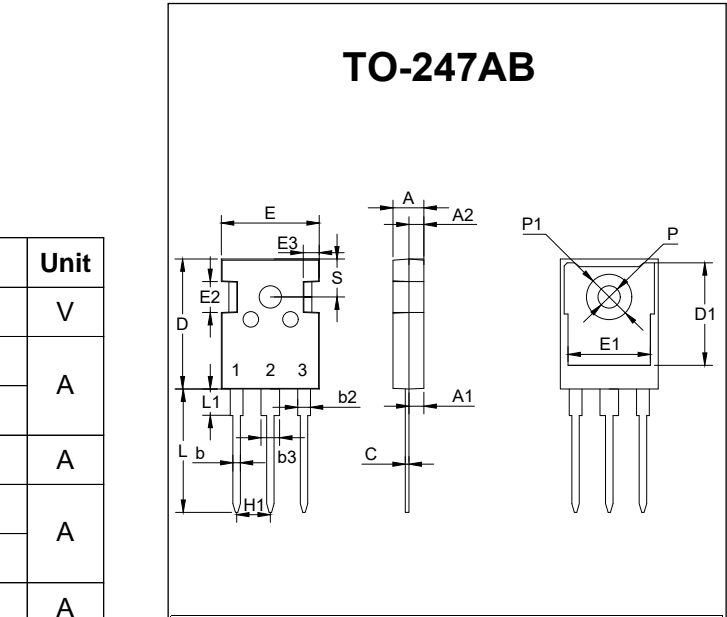
### Features

- AEC-Q101 Qualified
- Including Fast & Soft Recovery anti-Parallel FWD
- $V_{ce(sat)}$  with Positive Temperature Coefficient
- High Short Circuit Capability (10 $\mu$ s)
- Very Tight Parameter Distribution
- Halogen Free. "Green" Device (Note 1)
- Epoxy Meets UL 94 V-0 Flammability Rating
- Lead Free Finish/RoHS Compliant (Note 2)("P" Suffix Designates RoHS Compliant. See Ordering Information)

### Maximum Ratings

- Operating Junction Temperature Range : -40°C to +175°C
- Storage Temperature Range: -55°C to +150°C
- IGBT Thermal Resistance: 0.35°C/W Junction to Case
- Diode Thermal Resistance: 0.65°C/W Junction to Case
- Thermal Resistance: 40°C/W Junction to Ambient

# Trench and Field Stop IGBT 1200V 40A

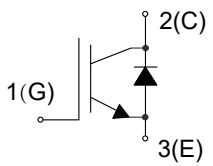


DIMENSIONS					
DIM	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	0.189	0.205	4.80	5.20	
A1	0.087	0.103	2.21	2.61	
A2	0.073	0.085	1.85	2.15	
b	0.039	0.055	1.00	1.40	
b2	0.075	0.087	1.91	2.21	
C	0.020	0.028	0.50	0.70	
D	0.815	0.839	20.70	21.30	
D1	0.640	0.663	16.25	16.85	
E	0.610	0.634	15.50	16.10	
E1	0.512	0.535	13.00	13.60	
E2	0.189	0.205	4.80	5.20	
E3	0.091	0.106	2.30	2.70	
L	0.772	0.796	19.62	20.22	
L1	-	0.169	-	4.30	
P	0.134	0.150	3.40	3.80	Φ
P1		0.287	-	7.30	Φ
S	0.242		6.15		TYP
H1	0.214		5.44		TYP
b3	0.110	0.126	2.80	3.20	

Parameter	Symbol	Rating	Unit
Collector-Emitter Voltage	$V_{CE}$	1200	V
DC Collector Current <sup>(Note 3)</sup>	$I_C$	$T_C=25^\circ C$	80
		$T_C=100^\circ C$	40
Pulsed Collector Current <sup>(Note 4)</sup>	$I_{C,pulse}$	160	A
Diode Forward Current <sup>(Note 3)</sup>	$I_F$	$T_C=25^\circ C$	80
		$T_C=100^\circ C$	40
Diode Pulsed Current <sup>(Note 4)</sup>	$I_{F,pulse}$	160	A
Gate-Emitter Voltage	$V_{GE}$	$\pm 20$	V
Transient Gate-Emitter Voltage <sup>(Note 5)</sup>		$\pm 30$	
Short Circuit Withstand Time <sup>(Note 6)</sup>	$t_{SC}$	10	$\mu s$
$V_{GE}=15V, V_{CC}=600V, T_J \le 150^\circ C$			
Power Dissipation	$P_D$	$T_C=25^\circ C$	428
		$T_C=100^\circ C$	214

- Note:
1. Halogen free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
  2. High Temperature Solder Exemptions Applied, see EU Directive Annex 7a.
  3. Limited by  $T_{Jmax}$ .
  4.  $T_p$  limited by  $T_{Jmax}$ .
  5.  $T_p \le 10\mu s$ , Duty Cycle < 1%
  6. Allowed number of short circuits: < 1000; time between short circuits: > 1s.

### Internal Structure



**Electrical Characteristics of the IGBT @ 25°C (Unless Otherwise Specified)**

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>IGBT Static Characteristics</b>						
Collector-Emitter Breakdown Voltage	$V_{(BR)CES}$	$V_{GE}=0V, I_C=250\mu A$	1200			V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_C=40A, T_J=25^\circ C$		1.85	2.40	V
		$V_{GE}=15V, I_C=40A, T_J=125^\circ C$		2.20		
		$V_{GE}=15V, I_C=40A, T_J=150^\circ C$		2.30		
G-E Threshold Voltage	$V_{GE(th)}$	$I_C=1.4mA, V_{CE}=V_{GE}$	4.8	5.6	6.5	V
C-E Leakage Current	$I_{CES}$	$V_{CE}=1200V, V_{GE}=0V, T_J=25^\circ C$			0.25	mA
		$V_{CE}=1200V, V_{GE}=0V, T_J=150^\circ C$			5	
G-E Leakage Current	$I_{GES}$	$V_{CE}=0V, V_{GE}=\pm 20V$			200	nA
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{ies}$	$V_{CE}=25V, V_{GE}=0V, f=1MHz$		2.5		nF
Reverse Transfer Capacitance	$C_{res}$			0.09		
Gate Charge	$Q_g$	$V_{CC}=960V, I_C=40A, V_{GE}=15V$		0.33		$\mu C$
Short Circuit Collector Current	$I_{SC}$	$V_{GE}=15V, t_{sc}\leq 10\mu s, V_{CC}=600V, T_J\leq 150^\circ C$		150		A
<b>IGBT Switching Characteristics</b>						
Turn-On Delay Time	$t_{d(on)}$	$V_{CC}=600V, I_C=40A, V_{GE}=\pm 15V, R_G=12\Omega, T_J=25^\circ C$		45		ns
Rise Time	$t_r$			56		
Turn-Off Delay Time	$t_{d(off)}$			180		
Fall Time	$t_f$			80		mJ
Turn-On Energy	$E_{on}$			3.8		
Turn-Off Energy	$E_{off}$			1.7		
Turn-On Delay Time	$t_{d(on)}$	$V_{CC}=600V, I_C=40A, V_{GE}=\pm 15V, R_G=12\Omega, T_J=125^\circ C$		50		ns
Rise Time	$t_r$			58		
Turn-Off Delay Time	$t_{d(off)}$			240		
Fall Time	$t_f$			85		mJ
Turn-On Energy	$E_{on}$			5.4		
Turn-Off Energy	$E_{off}$			2.7		
Turn-On Delay Time	$t_{d(on)}$	$V_{CC}=600V, I_C=40A, V_{GE}=\pm 15V, R_G=12\Omega, T_J=150^\circ C$		53		ns
Rise Time	$t_r$			60		
Turn-Off Delay Time	$t_{d(off)}$			260		
Fall Time	$t_f$			90		mJ
Turn-On Energy	$E_{on}$			5.8		
Turn-Off Energy	$E_{off}$			3.0		

**Electrical Characteristics of the Diode @ 25°C (Unless Otherwise Specified)**

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Diode Characteristics</b>						
Diode Forward Voltage	$V_F$	$V_{GE}=0V, I_F=40A, T_J=25^\circ C$	1.6	2.0	2.6	V
		$V_{GE}=0V, I_F=40A, T_J=125^\circ C$		1.8		
		$V_{GE}=0V, I_F=40A, T_J=150^\circ C$		1.7		
Reverse Recovery Current	$I_{rr}$	$V_R=600V, I_F=40A,$ $di_F/dt=-520A/\mu s, T_J=25^\circ C$		14		A
Diode Reverse Recovery Time	$t_{rr}$			439		ns
Reverse Recovery Charge	$Q_{rr}$			2.55		$\mu C$
Reverse Recovery Energy	$E_{rec}$			0.9		mJ
Reverse Recovery Current	$I_{rr}$	$V_R=600V, I_F=40A,$ $di_F/dt=-520A/\mu s, T_J=125^\circ C$		18		A
Diode Reverse Recovery Time	$t_{rr}$			628		ns
Reverse Recovery Charge	$Q_{rr}$			6.33		$\mu C$
Reverse Recovery Energy	$E_{rec}$			2.05		mJ
Reverse Recovery Current	$I_{rr}$	$V_R=600V, I_F=40A,$ $di_F/dt=-520A/\mu s, T_J=150^\circ C$		20		A
Diode Reverse Recovery Time	$t_{rr}$			773		ns
Reverse Recovery Charge	$Q_{rr}$			7.05		$\mu C$
Reverse Recovery Energy	$E_{rec}$			2.25		mJ

## Curve Characteristics

Fig. 1 - Typical Output Characteristic( $T_J=25^\circ\text{C}$ )

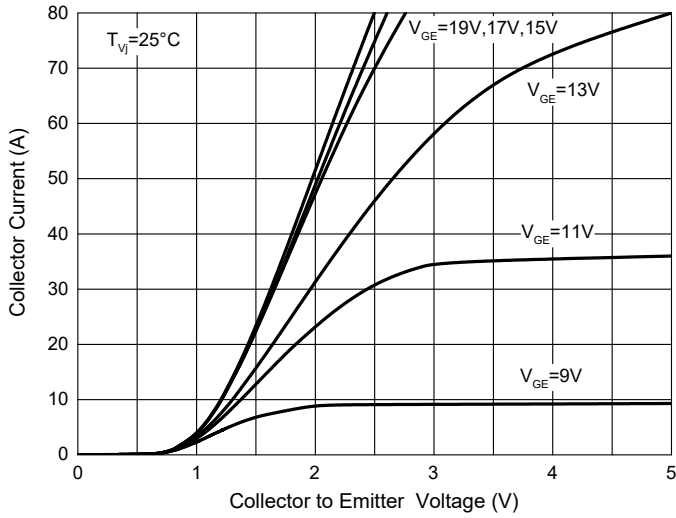


Fig. 2 - Typical Output Characteristic ( $T_J=150^\circ\text{C}$ )

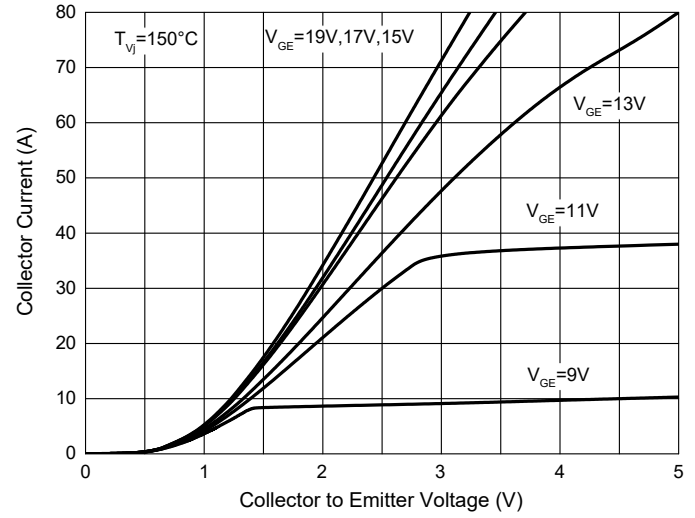


Fig. 3 - Typical Transfer Characteristic

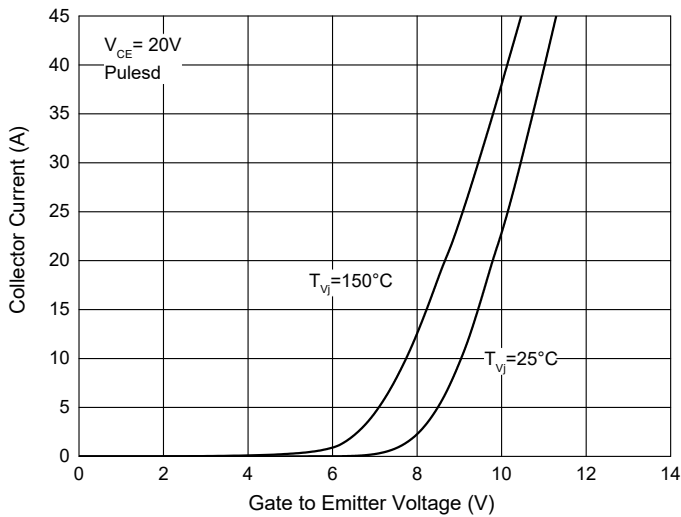


Fig. 4 - Diode Forward Current as a function of Forward Voltage

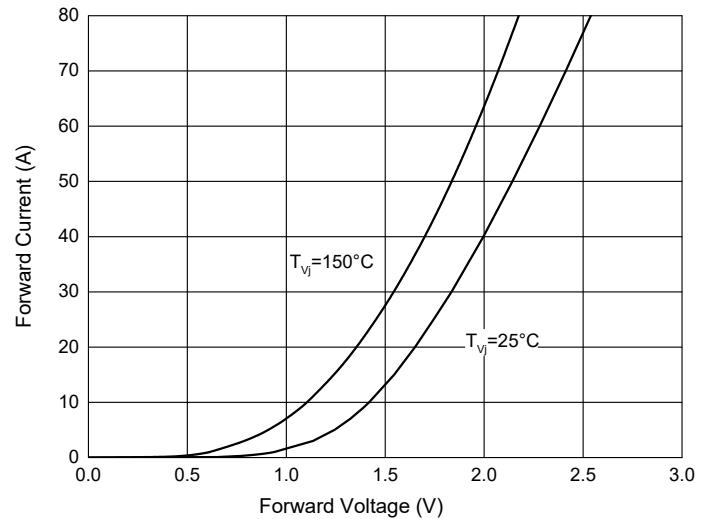


Fig. 5 - IGBT Transient Thermal Impedance

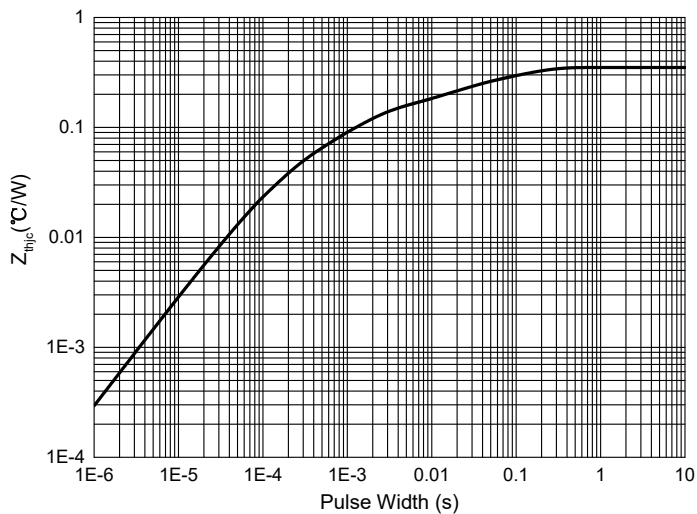
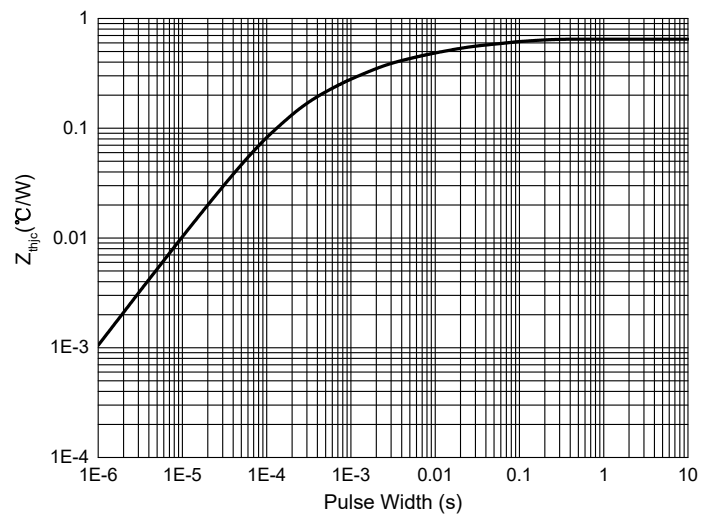


Fig. 6 - Diode Transient Thermal Impedance



**Curve Characteristics**

Fig. 7 - IGBT Switching Loss vs  $I_C$

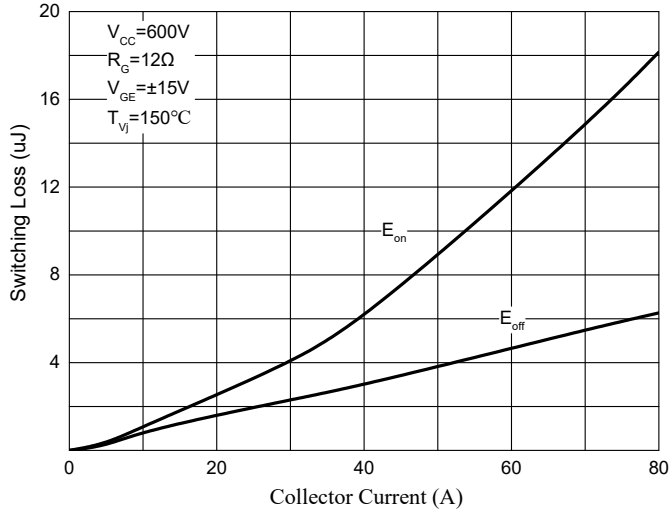


Fig. 8- IGBT Switching Loss vs  $R_G$

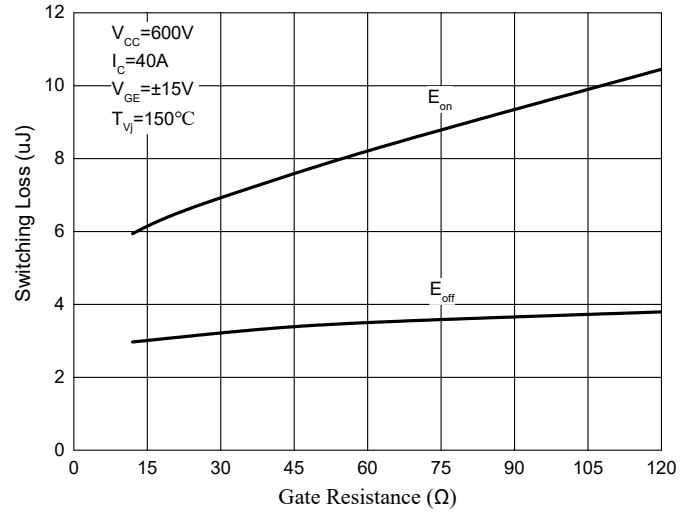


Fig. 9 - Diode Switching Loss ( $E_{rec}$ ) vs  $I_F$

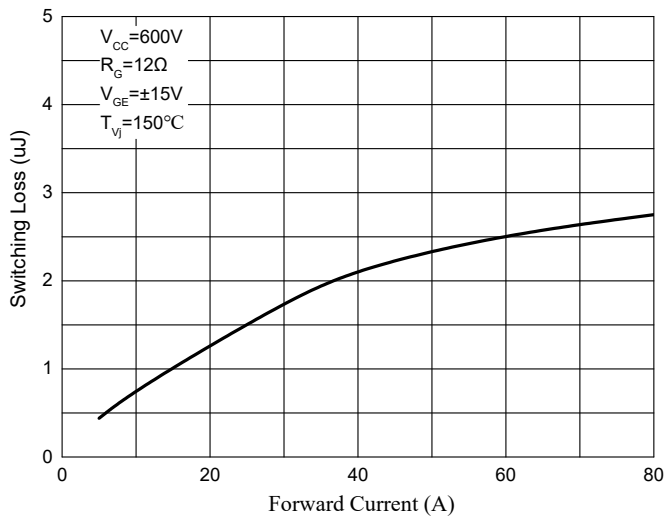


Fig. 10- Diode Switching Loss ( $E_{rec}$ ) vs  $R_G$

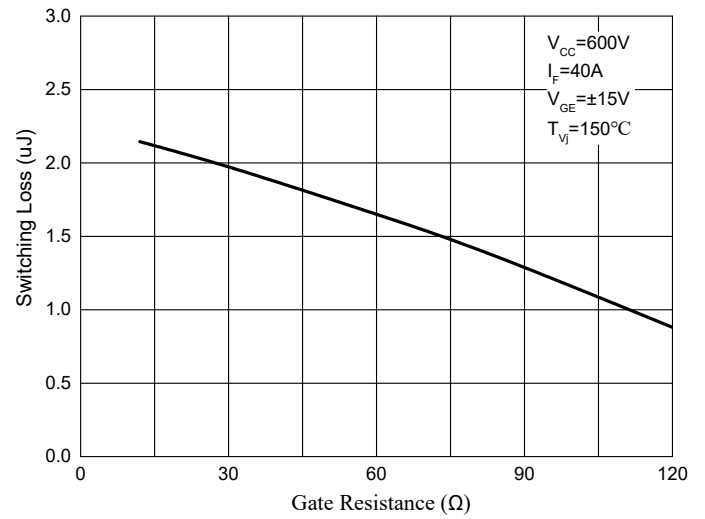
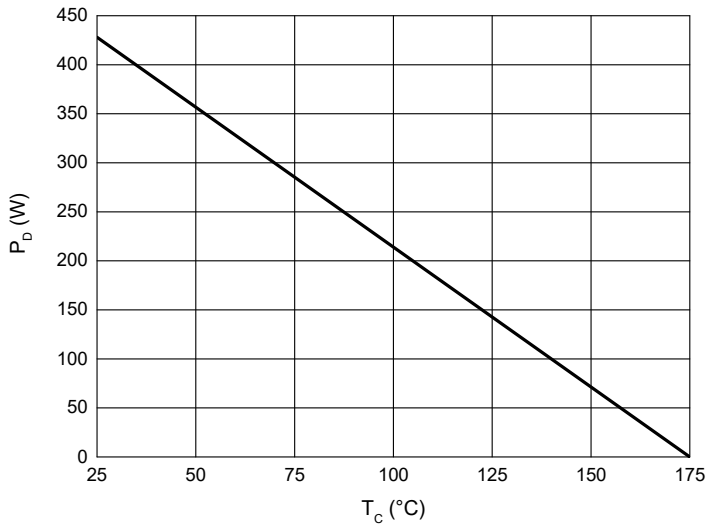


Fig. 11 - Power Dissipation as a function of Case Temperature



## Ordering Information

Device	Packing
Part Number-BP	Tube: 30pcs/Tube, 360pcs/Box, 1800pcs/Ctn

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