

650 V Trench and Fieldstop IGBT

PRODUCT SUMMARY		
V_{CE} (V)	650	
I_C (A)	90 (TC=25 °C)	75 (TC=100 °C)
$V_{CE(sat)}$ (V)	1.8	
Q_g (nC)	175	
I_{CM} (A)	225	

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)

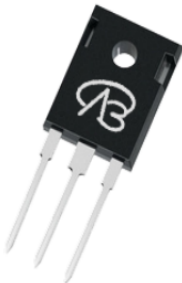


RoHS
COMPLIANT
HALOGEN
FREE

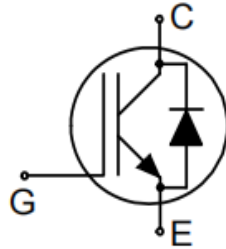
APPLICATIONS

- 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)

TO-247



Top View



Package pin definition

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

ABSOLUTE MAXIMUM RATINGS ($T_C = 25\text{ °C}$, unless otherwise noted)					
PARAMETER		SYMBOL	LIMIT	UNIT	
Collector-Emitter Voltage		V_{CE}	650	V	
Gate-Emitter Voltage		V_{GE}	± 30		
Continuous Collector Current ($T_J = 150\text{ °C}$)	V_{GE} at 15 V	I_C	$T_C = 25\text{ °C}$	90	A
			$T_C = 100\text{ °C}$	75	
Pulsed Collector Current ^a		I_{CM}	225		
Diode Forward Current ^b		I_F	90	A	
Maximum Power Dissipation		P_D	$T_C = 25\text{ °C}$	400	W
			$T_C = 100\text{ °C}$	220	W
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55 to +175	°C	
Short Circuit Withstand Time $T_C=150$	$V_{GE}= 15V, V_{CE} = 400V$	tsc	3	μs	
Short Circuit Withstand Time $T_C=100$	$V_{GE}= 15V, V_{CE} = 330V$		5		
Soldering Recommendations (Peak Temperature) ^c			for 10 s	260	°C

Notes

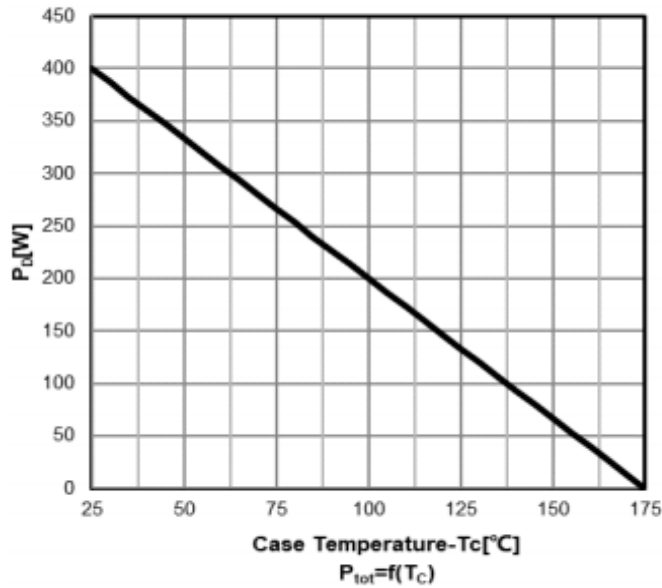
- Repetitive rating; pulse width limited by maximum junction temperature.
- Current limited by maximum junction temperature.
- 1.6 mm from case.

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

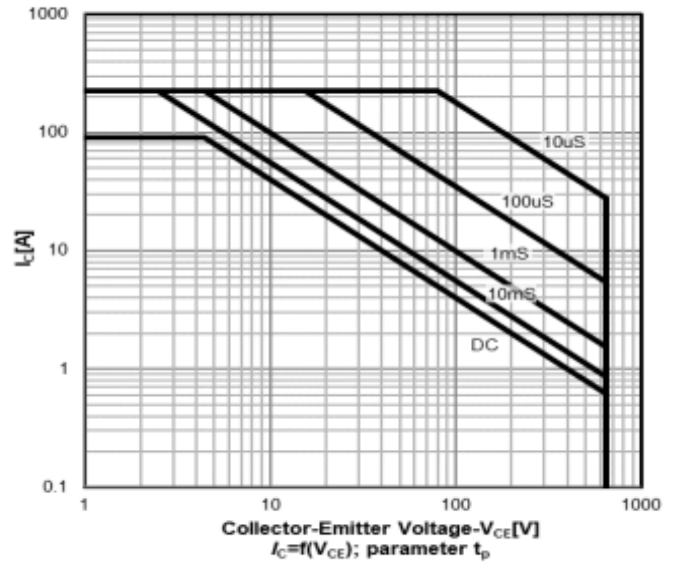
SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Collector-Emitter Breakdown Voltage	BV_{CE}	$V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$ $V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$		650 650	- -	- -	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}	$V_{CE} = 650\text{ V}, V_{GE} = 0\text{ V}, T_J = 25\text{ }^\circ\text{C}$		-	1	20	μA
		$V_{CE} = 650\text{ V}, V_{GE} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$		-	1000	-	μA
Gate-Emitter Leakage Current	I_{GES}	$V_{CE} = 0\text{ V}, V_{GS} = \pm 2.0\text{ V}$		-	-	100	nA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE} = 15\text{ V}$	$I_C = 75\text{ A}$	-	1.8	2.1	V
Forward Transconductance	g_{fs}	$V_{CE} = 20\text{ V}, I_C = 75\text{ A}$		-	40	-	S
Dynamic							
Input Capacitance	C_{ies}	$V_{GE} = 0\text{ V}, V_{CE} = 25\text{ V},$ $f = 500\text{ KHz}$		-	4500	-	pF
Output Capacitance	C_{oes}			-	235	-	
Reverse Transfer Capacitance	C_{res}			-	72	-	
Turn-on Energy	E_{on}	$V_{CE} = 400\text{ V}, V_{GE} = 0/15\text{V},$ $I_C = 75\text{ A}, R_g = 10\Omega$		-	0.62	-	ns
Turn-off Energy	E_{off}			-	0.31	-	
Total Gate Charge	Q_g	$V_{GE} = 15\text{ V}$	$I_C = 75\text{ A}, V_{CE} = 400\text{ V}$	-	175	-	nC
Gate-Emitter Charge	Q_{ge}			-	14	-	
Gate to Collector Charge	Q_{gc}			-	33	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{CE} = 400\text{ V}, V_{GE} = 0/15\text{V},$ $I_C = 75\text{ A}, R_g = 10\Omega$		-	60	-	ns
Rise Time	t_r			-	43	-	
Turn-Off Delay Time	$t_{d(off)}$			-	184	-	
Fall Time	t_f			-	30	-	
Internal emitter inductance measured 5 mm	L_E			-	13	-	
Diode Characteristics							
Diode Forward Current	I_F	IGBT symbol showing the integral reverse junction diode		-	-	90	A
Pulsed Diode Forward Current	I_{FM}			-	-	225	
Diode Forward Voltage	V_F	$I_F = 30\text{ A}$		-	1.65	2.0	V
Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = 30\text{ A},$ $dI_F/dt = 200\text{ A}/\mu\text{s}, V_R = 400\text{ V}$		-	73	-	ns
Reverse Recovery Charge	Q_{rr}			-	80	-	μC
Reverse Recovery Current	I_{RRM}			-	13	-	A

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

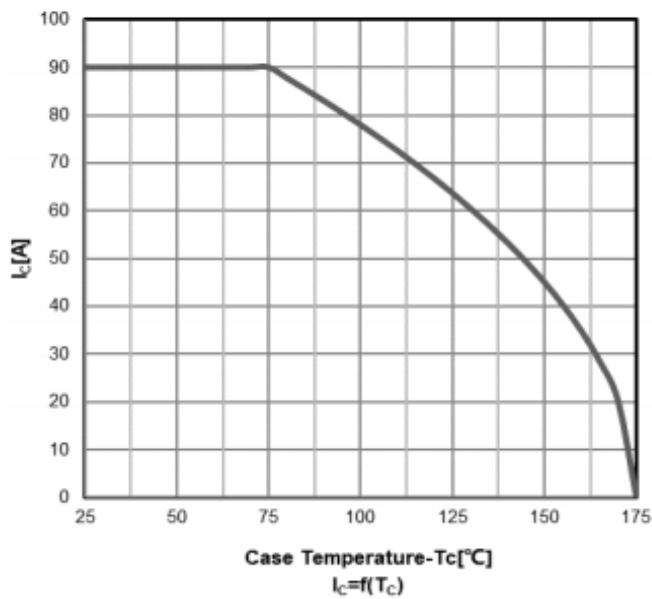
Power dissipation



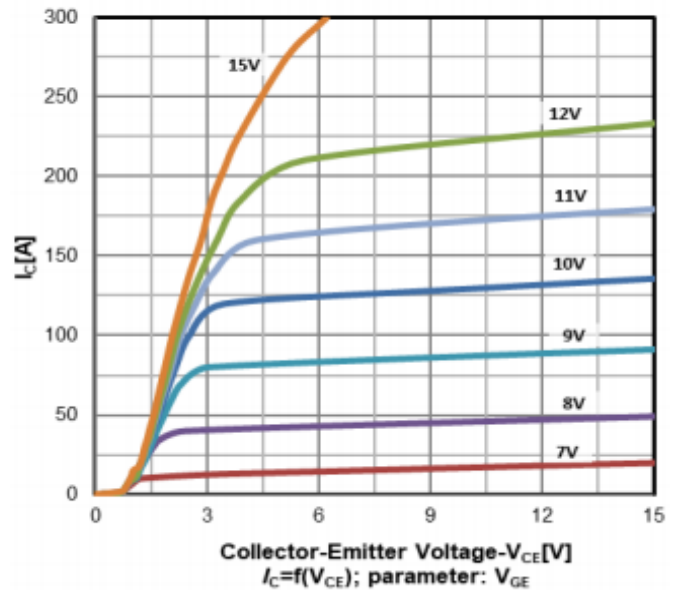
Safe operating area $T_a=25\text{ °C}$



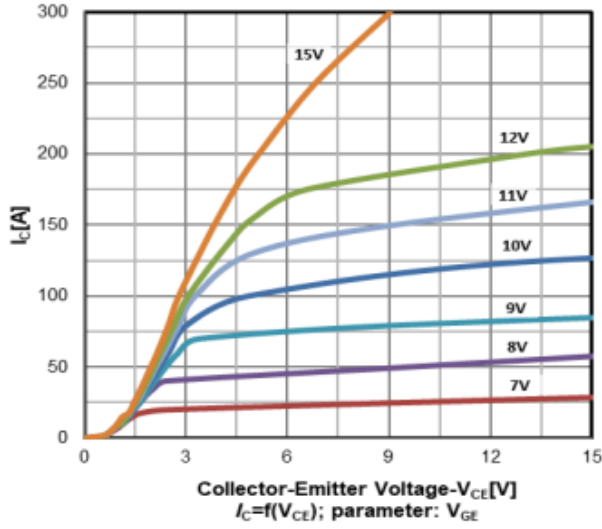
Collector current as a function of Case temperature



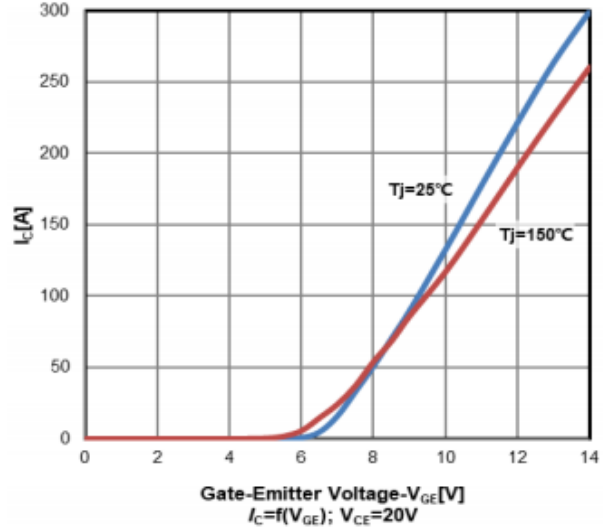
Typ. Output characteristics $T_j=25\text{ °C}$



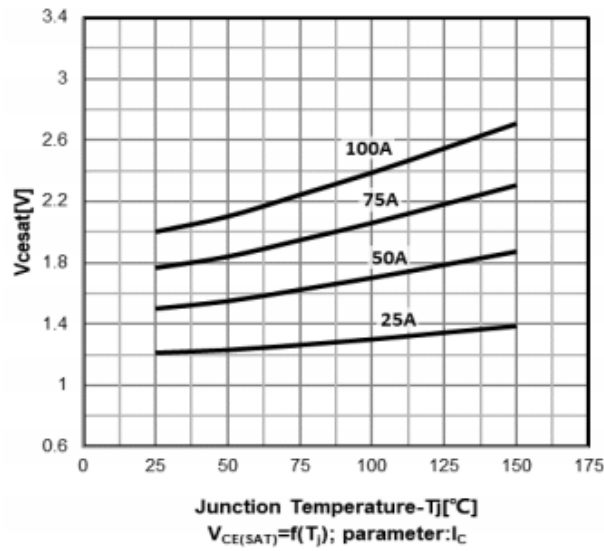
Typ. Output characteristics
 $T_j=150\text{ }^\circ\text{C}$



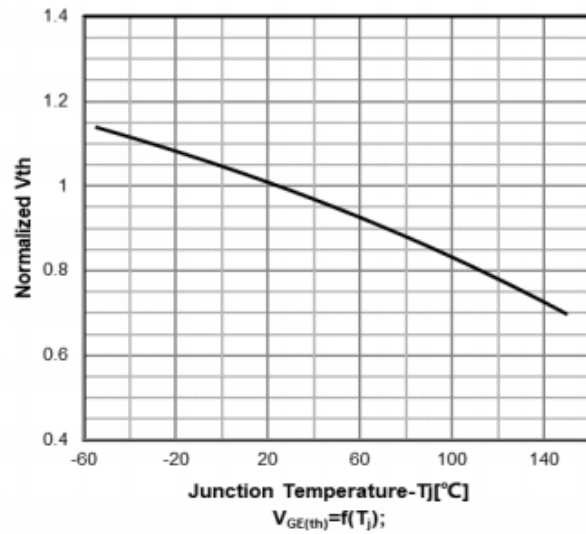
Typ. Transfer characteristics



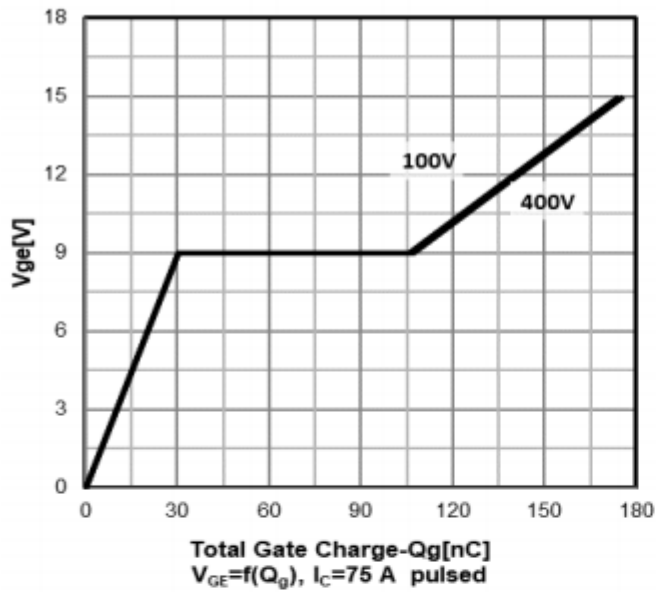
Typ. Collector-emitter saturation voltage as a function of junction temperature ($V_{GE}=15\text{V}$)



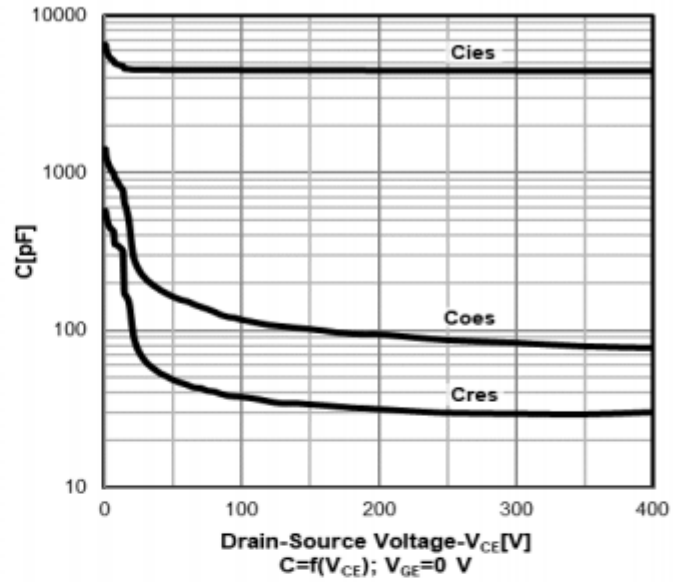
Normalized $V_{GE(th)}$ vs. temperature



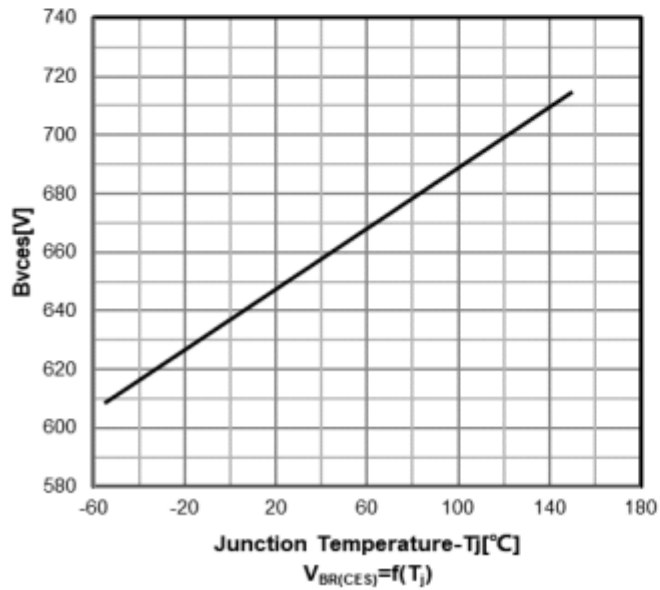
Gate charge characteristics



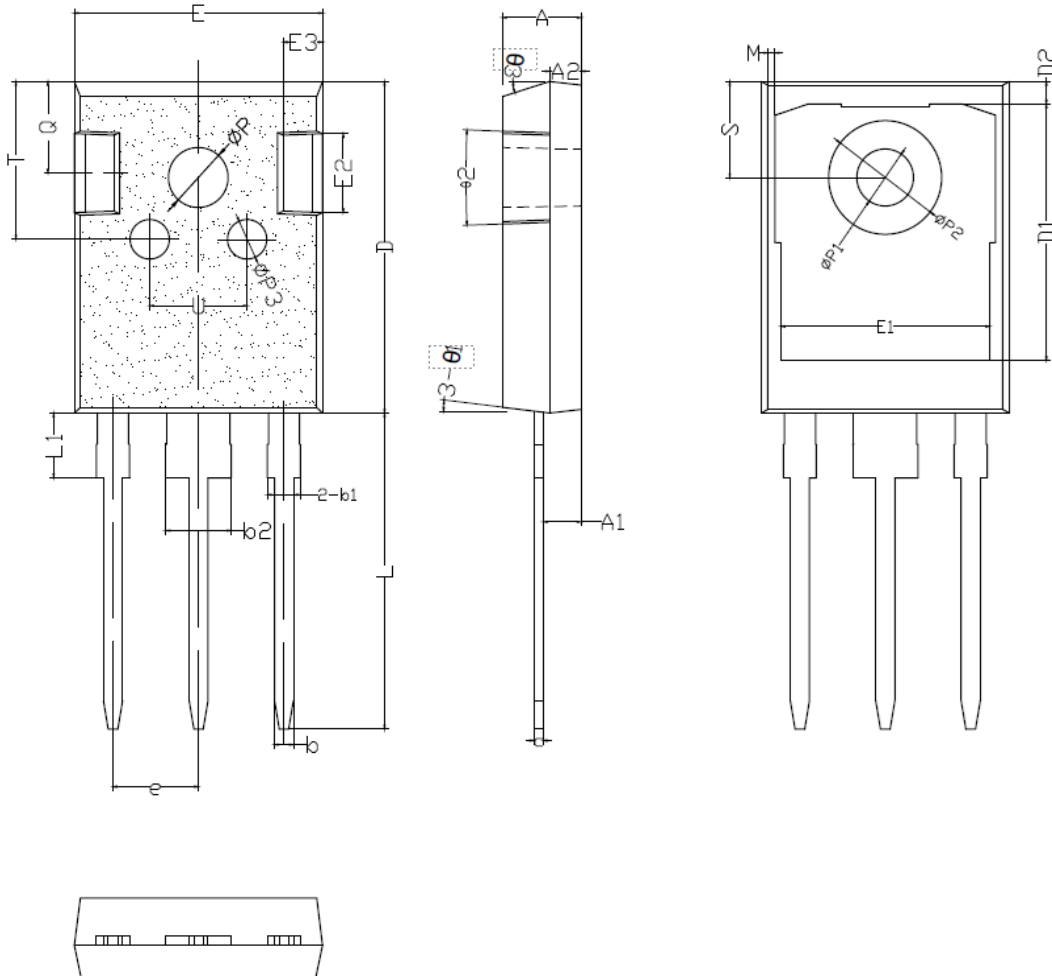
Capacitance characteristics



Collector-emitter breakdown voltage vs. temperature



TO-247 PACKAGE OUTLINE DIMENSIONS



SYMBOL	mm		
	MIN	NOM	MAX
*A	4.90	5.00	5.10
*A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
*b	1.15	1.20	1.25
*b1	1.95	2.10	2.25
*b2	2.95	3.10	3.25
*c	0.55	0.60	0.65
*D	20.90	21.00	21.10
D1	16.35	16.55	16.75
D2	1.05	1.20	1.35

*E	15.70	15.80	15.90
E1	13.10	13.25	13.40
E2	4.85	4.95	5.10
E3	2.40	2.50	2.60
*e	5.40	5.44	5.48
*L	19.80	19.98	20.15
*L1	-	-	4.30
*ΦP	3.40	3.50	3.60
*ΦP1	6.90	7.10	7.30
ΦP2	2.40	2.50	2.60
ΦP3	2.40	2.50	2.60
Q	5.60	5.80	6.00
*S	6.05	6.15	6.25
T	9.80	10.00	10.20
U	6.00	6.20	6.40
θ1	5°	7°	9°
θ2	1°	3°	5°
θ3	13°	15°	17°

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