

FGP15N60UNDF-VB Datasheet

600V Trench and Fieldstop IGBT

PRODUCT SUMMARY		
V _{CE} (V)	600	
I _C (A)	30 (T _C =25 °C)	15 (T _C =100 °C)
V _{CE(sat)} (V)	1.6	
Q _g (nC)	65	
I _{CM} (A)	45	

FEATURES

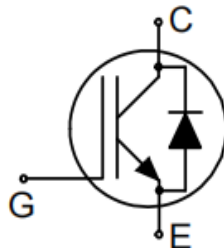
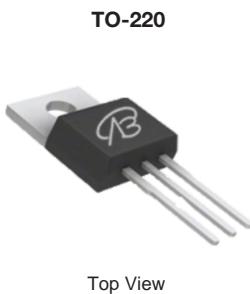
- Very Low V_{CEsat}
- Low turn-off losses
- High speed switching
- Maximum junction temperature 175°C
- Ultra low gate charge (Q_g)
- Avalanche energy rated (UIS)



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

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	I _C	T _C = 25 °C	30	A
			T _C = 100 °C	15	
Pulsed Collector Current ^a		I _{CM}	45		
Diode Forward Current ^b		I _F	60	A	
Maximum Power Dissipation		P _D	T _C = 25 °C	170	W
			T _C = 100 °C	31	W
Operating Junction and Storage Temperature Range		T _J , T _{stg}	-55 to +175	°C	
Short Circuit Withstand Time ^{TC=150}	V _{GE} = 15V, V _{CE} 400V	t _{sc}	3	µs	
Short Circuit Withstand Time ^{TC=100}	V _{GE} = 15V, V _{CE} 330V		5		
Soldering Recommendations (Peak Temperature) ^c	for 10 s		260	°C	

Notes

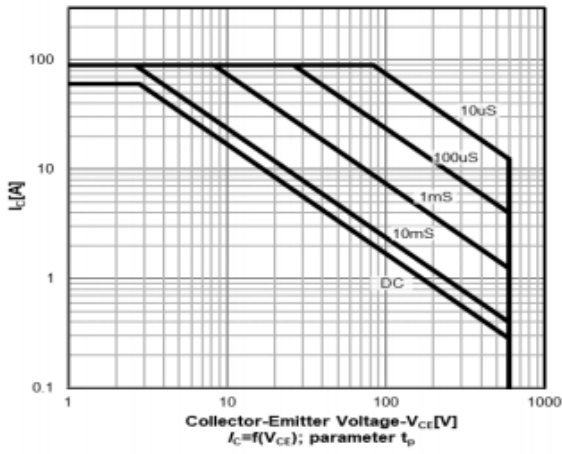
- Repetitive rating; pulse width limited by maximum junction temperature.
- Current limited by maximum junction temperature.
- 1.6 mm from case.

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	40	80	°C/W
Maximum Junction-to-Case	R_{thJC}	0.88	4.8	

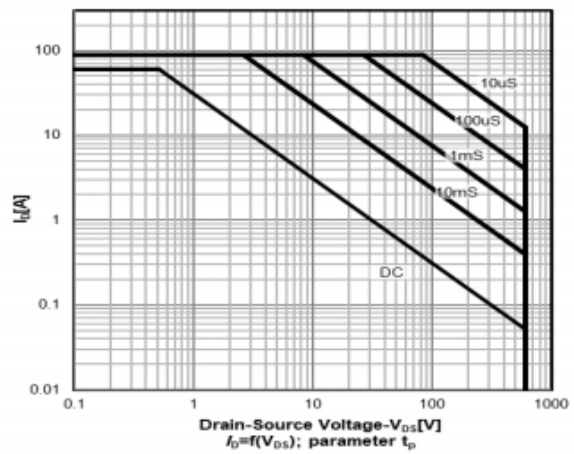
SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Collector-Emitter Breakdown Voltage	BV_{CE}	$V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$ $V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$		600 600	- -	- -	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}	$V_{CE} = 480\text{ V}, V_{GE} = 0\text{ V}, T_J = 25\text{ }^\circ\text{C}$		-	1	20	μA
		$V_{CE} = 480\text{ V}, V_{GE} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$		-	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	$V_{CE(sat)}$	$V_{GE} = 15\text{ V}$	$I_C = 30\text{ A}$	-	1.6	2.1	V
Forward Transconductance	g_{fs}	$V_{CE} = 20\text{ V}, I_C = 30\text{ A}$		-	16	-	S
Dynamic							
Input Capacitance	C_{ies}	$V_{GE} = 0\text{ V}, V_{CE} = 25\text{ V},$ $f = 500\text{ KHz}$		-	1800	-	pF
Output Capacitance	C_{oes}			-	82	-	
Reverse Transfer Capacitance	C_{res}			-	12	-	
Turn-on Energy	E_{on}	$V_{CS} = 400\text{ V}, V_{GE} = 0/15\text{ V},$ $I_C = 30\text{ A}, R_g = 10\text{ }\Omega$		-	0.62	-	ns
Turn-off Energy	E_{off}			-	0.31	-	
Total Gate Charge	Q_g	$V_{GE} = 15\text{ V}$	$I_C = 30\text{ A}, V_{CE} = 400\text{ V}$	-	65	-	nC
Gate-Emitter Charge	Q_{ge}			-	14	-	
Gate to Collector Charge	Q_{gc}			-	13	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{CS} = 400\text{ V}, V_{GE} = 0/15\text{ V},$ $I_C = 30\text{ A}, R_g = 10\text{ }\Omega$		-	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		-	-	15	A
Pulsed Diode Forward Current	I_{FM}			-	-	45	
Diode Forward Voltage	V_F	$I_F = 30\text{ A}$		-	1.35	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}			-	45	-	μC
Reverse Recovery Current	I_{RRM}			-	13	-	A

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

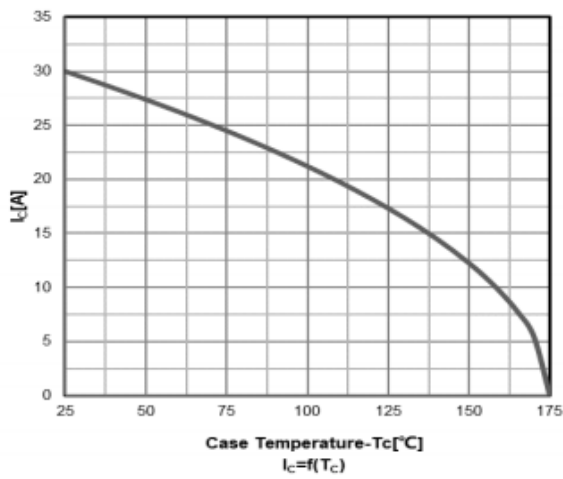
Safe operating area Ta=25 °C
Non-Full PAK



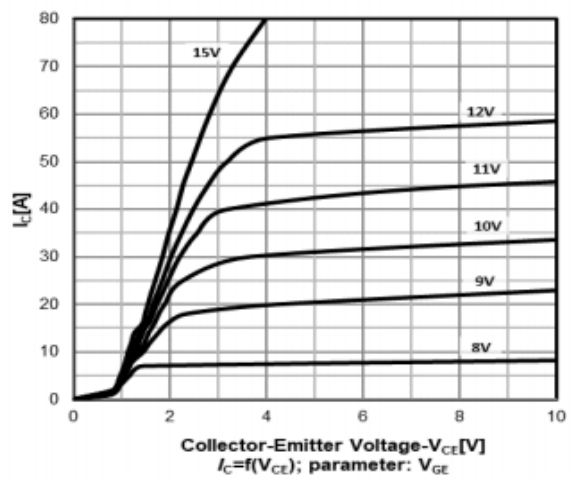
Safe operating area Ta=25 °C
Full PAK



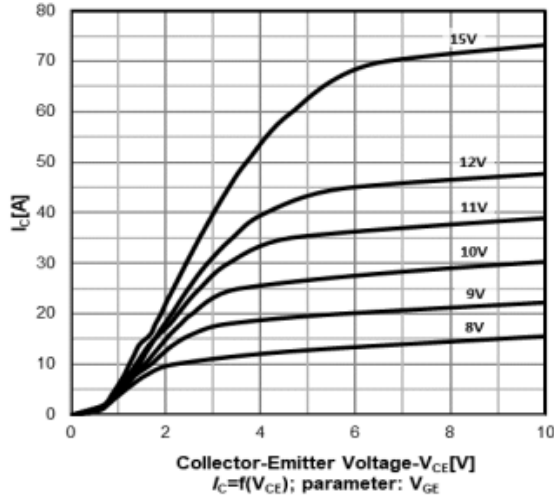
Collector current as a function of
Case temperature



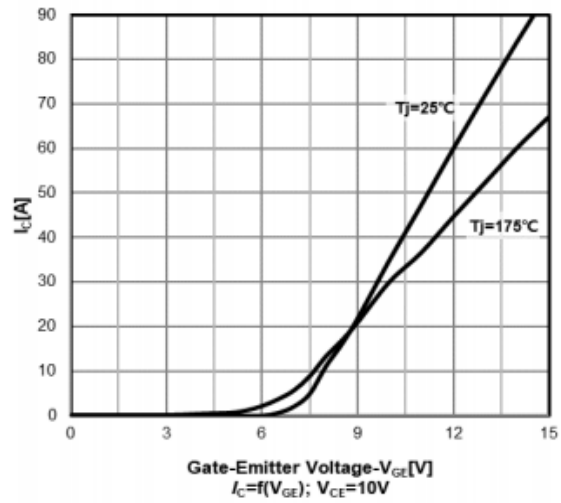
Typ. Output characteristics
Tj=25 °C



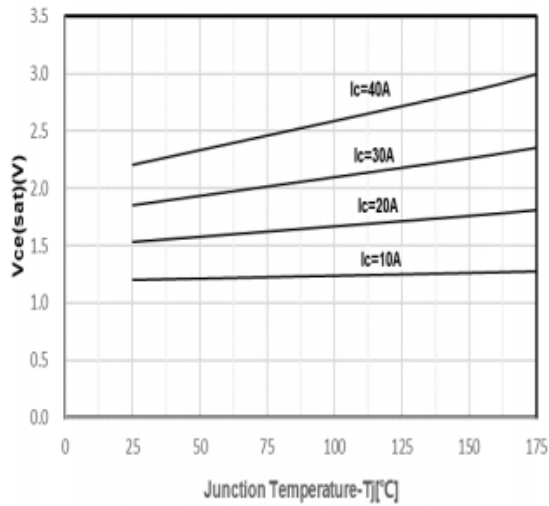
Typ. Output characteristics
 $T_j=175^\circ\text{C}$



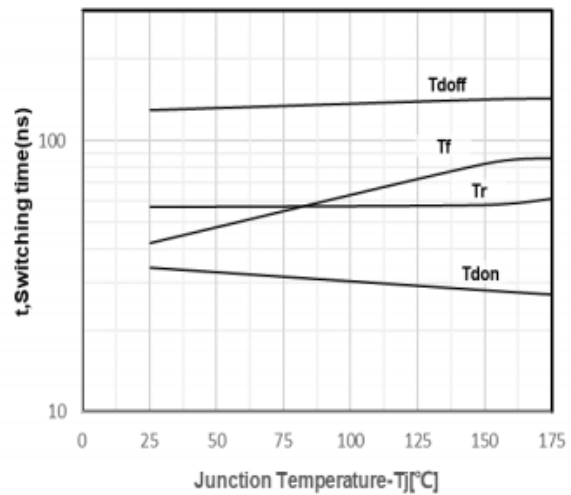
Typ. Transfer characteristics



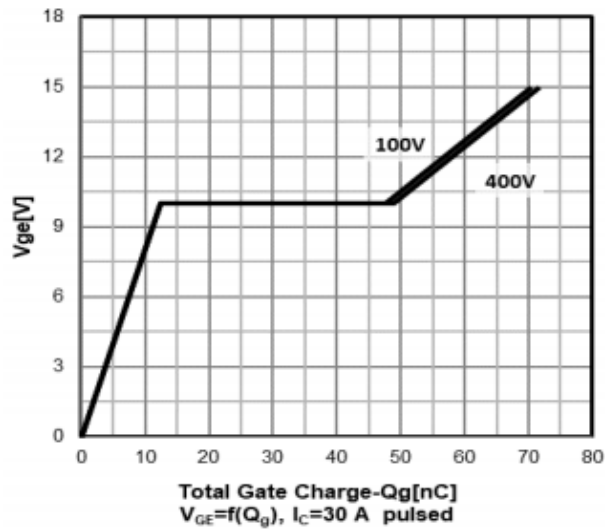
Typ. Collector-emitter saturation voltage as a function of junction temperature ($V_{ge}=15\text{V}$)



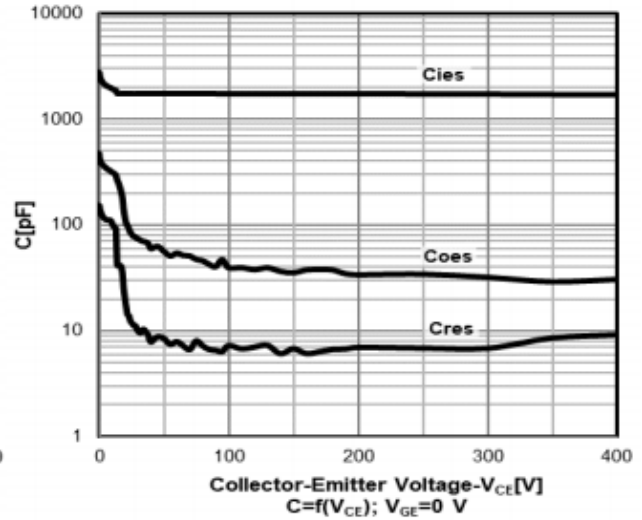
Typ. Switching times as a function of junction temperature (inductive load, $V_{ce}=400\text{V}$, $V_{ge}=0/15\text{V}$, $R_G=10\Omega$)



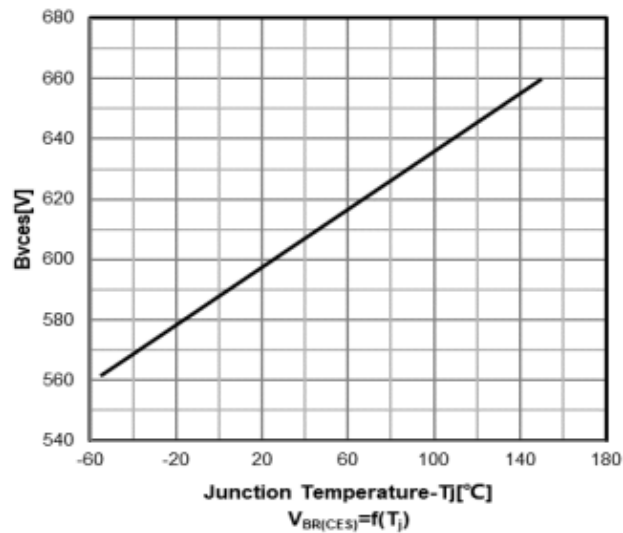
Gate charge characteristics



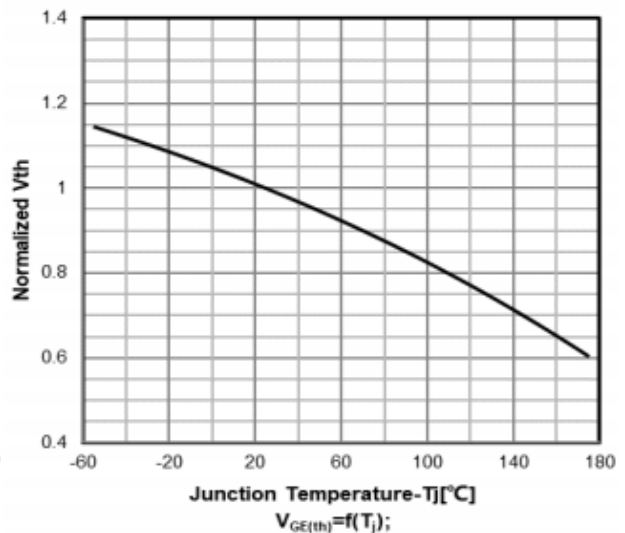
Capacitance characteristics



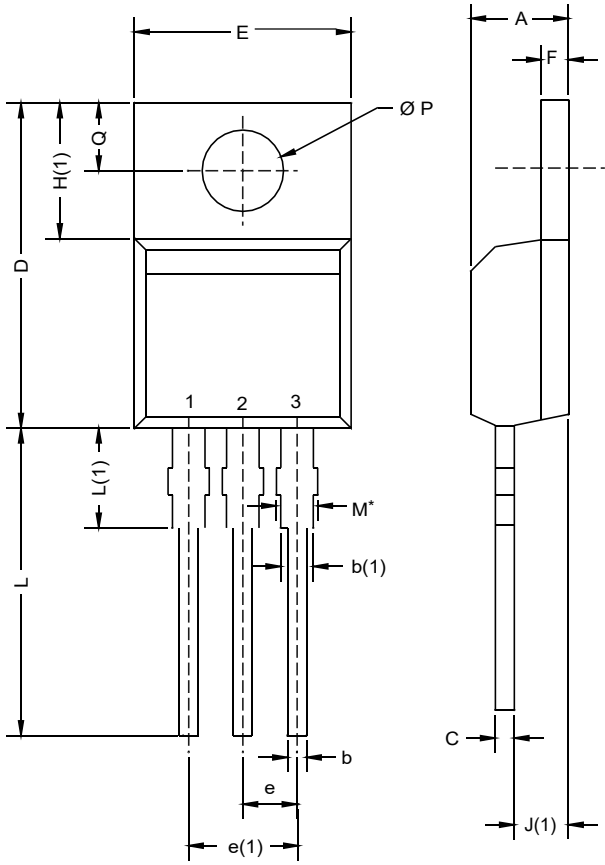
Collector-emitter breakdown voltage vs. temperature



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



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, DWG: 5471

Notes

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

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