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May 2014

FGB3040G2_F085 / FGD3040G2_F085 FGP3040G2_F085 / FGI3040G2_F085

EcoSPARK®2 300mJ, 400V, N-Channel Ignition IGBT

Features

- SCIS Energy = 300mJ at T_J = 25°C
- Logic Level Gate Drive
- Qualified to AEC Q101

JEDEC TO-252AA

D-Pak

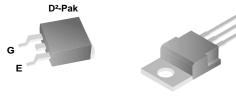
■ RoHS Compliant

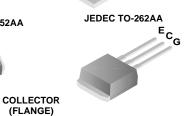
Applications

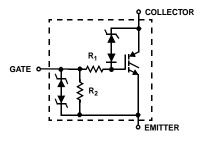
- Automotive Ignition Coil Driver Circuits
- Coil On Plug Applications



Package JEDEC TO-263AB D²-Pak JEDEC TO-220AB ECG







Device Maximum Ratings T_A = 25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
BV _{CER}	Collector to Emitter Breakdown Voltage (I _C = 1mA)	400	V
BV _{ECS}	Emitter to Collector Voltage - Reverse Battery Condition (I _C = 10mA)	28	V
E _{SCIS25}	Self Clamping Inductive Switching Energy (Note 1)	300	mJ
	Self Clamping Inductive Switching Energy (Note 2)	170	mJ
I _{C25}	Collector Current Continuous, at V _{GE} = 5.0V, T _C = 25°C	41	Α
I _{C110}	Collector Current Continuous, at V _{GE} = 5.0V, T _C = 110°C	25.6	Α
V_{GEM}	Gate to Emitter Voltage Continuous	±10	V
D	Power Dissipation Total, at T _C = 25°C	150	W
P_D	Power Dissipation Derating, for T _C > 25°C	1	W/°C
T_{J}	Operating Junction Temperature Range	-55 to +175	°C
T _{STG}	Storage Junction Temperature Range	-55 to +175	°C
T_L	Max. Lead Temp. for Soldering (Leads at 1.6mm from case for 10s)	300	°C
T _{PKG}	PKG Reflow soldering according to JESD020C		°C
ESD	HBM-Electrostatic Discharge Voltage at 100pF, 1500 Ω	4	kV
EOD	CDM-Electrostatic Discharge Voltage at 1Ω	2	kV

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGB3040G2	FGB3040G2_F085	TO-263AB	330mm	24mm	800
FGD3040G2	FGD3040G2_F085	TO-252AA	330mm	16mm	2500
FGP3040G2	FGP3040G2_F085	TO-220AB	Tube	N/A	50
FGI3040G2	FGI3040G2_F085	TO-262AA	Tube	N/A	50

Electrical Characteristics T_A = 25°C unless otherwise noted

Symbol Parameter Test Conditions Min Typ Max Ur

Off State Characteristics

BV _{CER}	Collector to Emitter Breakdown Voltage	I_{CE} = 2mA, V_{GE} = 0, tage R_{GE} = 1KΩ, T_{J} = -40 to 150°C		370	400	430	V
BV _{CES}	Collector to Emitter Breakdown Voltage	$T_{J} = -40 \text{ to } 150^{\circ}\text{C}$		390	420	450	٧
BV _{ECS}	Emitter to Collector Breakdown Voltage	ge I_{CE} = -20mA, V_{GE} = 0V, T_{J} = 25°C		28	-	1	V
BV _{GES}	Gate to Emitter Breakdown Voltage	nitter Breakdown Voltage I _{GES} = ±2mA		±12	±14	-	V
	Collector to Emitter Leakage Current	V_{CE} = 250V, R_{GE} = 1K Ω	$T_J = 25^{\circ}C$	-	-	25	μΑ
I _{CER}	ICER Collector to Emitter Leakage Current		$T_{J} = 150^{\circ}C$	-	-	1	mA
	Emitter to Collector Leakage Current	V _{EC} = 24V,	$T_{J} = 25^{\circ}C$	-	-	1	mA
I _{ECS}	Emilier to Collector Leakage Current		$T_{J} = 150^{\circ}C$	-	-	40	IIIA
R ₁	Series Gate Resistance			-	120	-	Ω
R ₂	Gate to Emitter Resistance			10K	-	30K	Ω

On State Characteristics

$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	$I_{CE} = 6A, V_{GE} = 4V,$	$T_{J} = 25^{\circ}C$	-	1.15	1.25	V
V _{CE(SAT)}	Collector to Emitter Saturation Voltage	I_{CE} = 10A, V_{GE} = 4.5V,	$T_J = 150^{\circ}C$	-	1.35	1.50	V
V _{CE(SAT)}	Collector to Emitter Saturation Voltage	$I_{CE} = 15A, V_{GE} = 4.5V,$	$T_J = 150^{\circ}C$	-	1.68	1.85	V
E _{SCIS}	Self Clamped Inductive Switching	L = 3.0 mHy,RG = 1KΩ,	TJ = 25°C	1	-	300	mJ
0010	·	VGE = 5V, (Note 1)					

Thermal Characteristics

R ₀ JC Thermal Resistance Junction to Case	-	-	1	°C/W
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Notes:

1: Self Clamping Inductive Switching Energy (E_{SCIS25}) of 300 mJ is based on the test conditions that starting Tj=25°C; L=3mHy, I_{SCIS} =14.2A, V_{CC} =100V during inductor charging and V_{CC} =0V during the time in clamp.

2: Self Clamping Inductive Switching Energy ($E_{SCIS150}$) of 170 mJ is based on the test conditions that starting Tj=150°C; L=3mHy, I_{SCIS} =10.8A, V_{CC} =100V during inductor charging and V_{CC} =0V during the time in clamp.

Min Typ Max Units

Electrical Characteristics $T_A = 25^{\circ}C$ unless otherwise noted

Parameter

Dynamic Characteristics							
Q _{G(ON)}	Gate Charge	I _{CE} = 10A, V _{CE} = 12V, V _{GE} = 5V		-	21	-	nC
V _{GE(TH)}	Gate to Emitter Threshold Voltage $I_{CE} = 1$ mA, $V_{CE} = V_{GE}$,	lor = 1mA Vor = Vor	$T_{J} = 25^{\circ}C$	1.3	1.7	2.2	V
▼GE(TH)		I'CE IIII'N, VCE VGE,	$T_{J} = 150^{\circ}C$	0.75	1.2	1.8	
V_{GEP}	Gate to Emitter Plateau Voltage	V _{CE} = 12V, I _{CE} = 10A		-	2.8	-	V

Test Conditions

Switching Characteristics

Symbol

t _{d(ON)R}	Current Turn-On Delay Time-Resistive	<u> </u>	-	0.9	4	μS
t _{rR}	Current Rise Time-Resistive	$V_{GE} = 5V, R_G = 1K\Omega$ $T_J = 25^{\circ}C,$	1	1.9	7	μS
t _{d(OFF)L}	Current Turn-Off Delay Time-Inductive	V _{CE} = 300V, L = 1mH,	-	4.8	15	μS
t _{fL}	Current Fall Time-Inductive	$V_{GE} = 5V, R_{G} = 1K\Omega$ $I_{CE} = 6.5A, T_{J} = 25^{\circ}C,$	-	2.0	15	μS

Typical Performance Curves

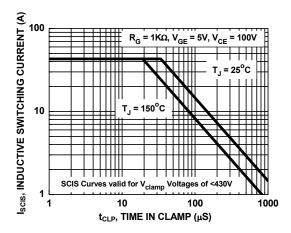
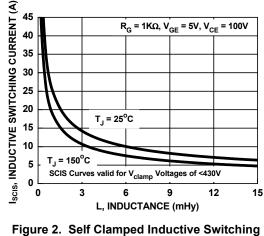


Figure 1. Self Clamped Inductive Switching Current vs. Time in Clamp



Current vs. Inductance

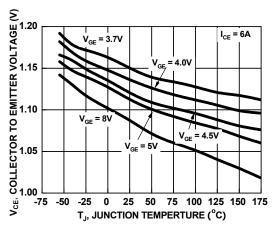


Figure 3. Collector to Emitter On-State Voltage vs. Junction Temperature

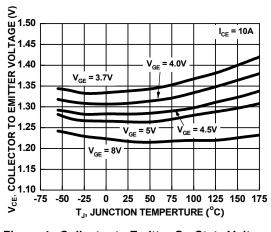


Figure 4. Collector to Emitter On-State Voltage vs. Junction Temperature

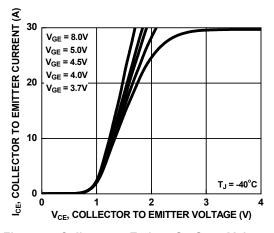


Figure 5. Collector to Emitter On-State Voltage vs. Collector Current

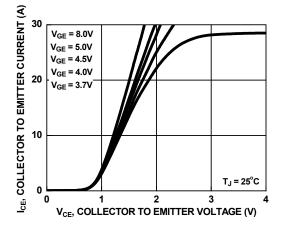


Figure 6. Collector to Emitter On-State Voltage vs. Collector Current

Typical Performance Curves (Continued)

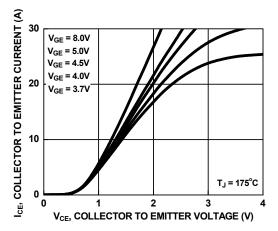


Figure 7. Collector to Emitter On-State Voltage vs. Collector Current

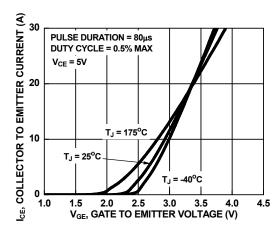


Figure 8. Transfer Characteristics

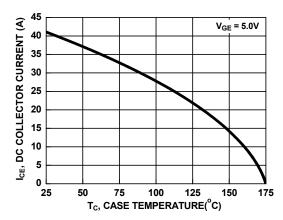


Figure 9. DC Collector Current vs. Case Temperature

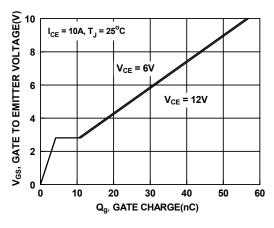


Figure 10. Gate Charge

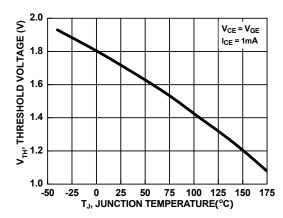


Figure 11. Threshold Voltage vs. Junction Temperature

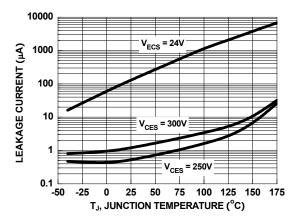
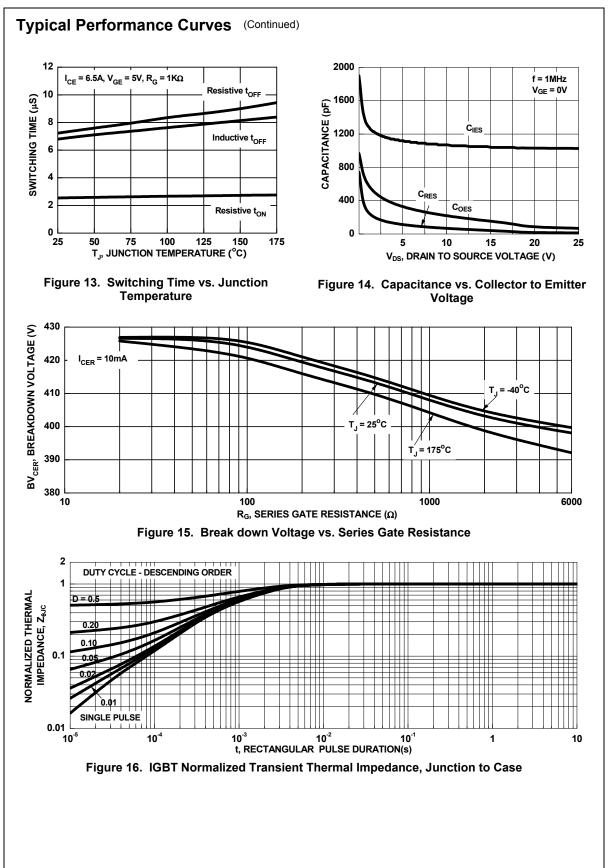
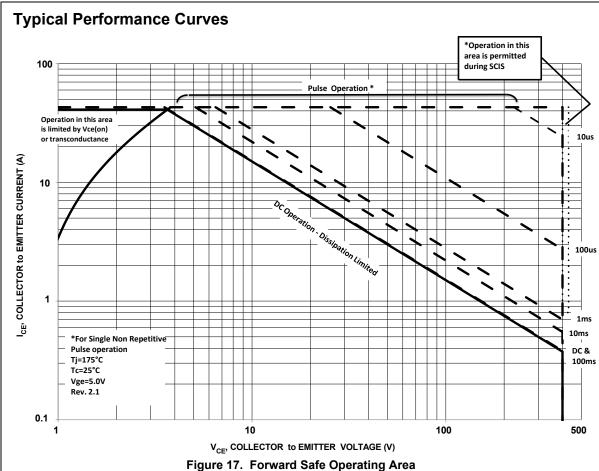
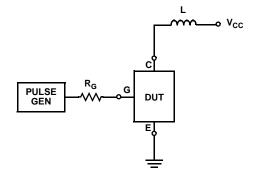


Figure 12. Leakage Current vs. Junction Temperature





Test Circuit and Waveforms



 $R_{G} = 1K\Omega$ DUT V_{CC}

Figure 18. Inductive Switching Test Circuit

Figure 19. t_{ON} and t_{OFF} Switching Test Circuit

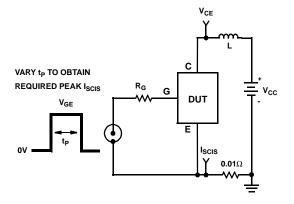


Figure 20. Energy Test Circuit

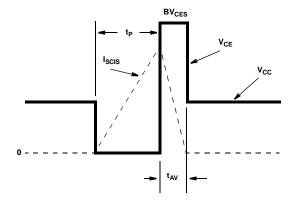


Figure 21. Energy Waveforms





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