

IGBT - Power, Co-PAK N-Channel, Field Stop VII (FS7), SCR, TO247-3L 1200 V, 1.5 V, 40 A

FGHL40T120RWD

Description

Using the novel field stop 7th generation IGBT technology and the Gen7 Diode in TO247 3-lead package, FGHL40T120RWD offers the optimum performance with low conduction losses and good switching controllability for a high efficiency operation in various applications like motor control, UPS, data center and high-power switch.

Features

- Low Conduction Loss and Optimized Switching
- Maximum Junction Temperature $T_J = 175$ °C
- Positive Temperature Coefficient for Easy Parallel Operation
- High Current Capability
- 100% of the Parts are Dynamically Tested
- Short Circuit Rated
- RoHS Compliant

Applications

- Motor Control
- UPS
- General Application Requiring High Power Switch

MAXIMUM RATINGS (T_{.I} = 25°C unless otherwise noted)

Param	Symbol	Value	Unit		
Collector-to-Emitter Voltage		V _{CES}	1200	V	
Gate-to-Emitter Voltage		V_{GES}	±20		
Transient Gate-to-Emitte	er Voltage		±30		
Collector Current	T _C = 25°C (Note 1)	I _C	80	Α	
	T _C = 100°C		40		
Power Dissipation	T _C = 25°C	P_{D}	600	W	
	T _C = 100°C		300		
Pulsed Collector Current	$T_C = 25^{\circ}C \text{ (Note 2)},$ $t_p = 10 \mu\text{s}$	I _{CM}	120	Α	
Diode Forward	T _C = 25°C (Note 1)	I _F	80		
Current	T _C = 100°C		40		
Pulsed Diode Maximum Forward Current	$T_C = 25^{\circ}C,$ $t_p = 10 \ \mu s \ (Note 1)$	I _{FM}	120		
Short Circuit Withstand T V _{GE} = 15 V, V _{CC} = 600 V	T _{SC}	5	μs		
Operating Junction and S Range	T _J , T _{stg}	-55 to +175	°C		
Lead Temperature for So	TL	260			

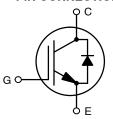
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

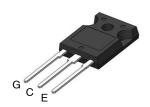
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- 1. Value limit by bond wire.
- 2. Repetitive rating: pulse width limited by max. Junction temperature.

BV _{CES}	V _{CE(SAT)}	Ic
1200 V	1.5 V	40 A

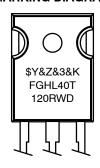
PIN CONNECTIONS





TO-247-3LD CASE 340CX

MARKING DIAGRAM



\$Y = onsemi Logo &Z = Assembly Plant Code &3 = 3-Digit Date Code &K = 2-Digit Lot Traceability Code FGHL40T120RWD = Specific Device Code

ORDERING INFORMATION

Device	Package	Shipping
FGHL40T120RWD	TO-247 (Pb-Free)	30 Units / Tube

THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case for IGBT	$R_{ heta JC}$	0.25	°C/W
Thermal Resistance, Junction-to-Case for Diode	$R_{\theta JCD}$	0.42	
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	40	

ELECTRICAL CHARACTERISTICS OF IGBT (T_J = 25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Тур	Max	Unit
OFF CHARACTERISTICS	•				-	
Collector-to-Emitter Breakdown Voltage	BV _{CES}		1200			V
Collector-to-Emitter Breakdown Voltage Temperature Coefficient	$\Delta BV_CES / \Delta T_J$	$V_{GE} = 0 \text{ V, I}_{C} = 5 \text{ mA}$		1226		mV/°C
Zero Gate Voltage Collector Current	I _{CES}	V _{GE} = 0 V, V _{CE} = V _{CES}			40	μΑ
Gate-to-Emitter Leakage Current	I _{GES}	V _{GE} = 20 V, V _{CE} = 0 V			±400	nA
ON CHARACTERISTICS	•				-	
Gate Threshold Voltage	V _{GE(th)}	$V_{GE} = V_{CE}, I_{C} = 40 \text{ mA},$ $T_{J} = 25^{\circ}\text{C}$	4.9	5.94	6.7	V
Collector-to-Emitter Saturation Voltage	V _{CE(sat)}	V _{GE} = 15 V, I _C = 40.3 A, T _J = 25°C	1.2	1.49	1.8	
		V _{GE} = 15 V, I _C = 40.3 A, T _J = 175°C		1.83		
DYNAMIC CHARACTERISTICS	•			•		
Input Capacitance	C _{ies}			4670		pF
Output Capacitance	C _{oes}	V _{GE} = 0 V, V _{CE} = 30 V, f = 1 MHz		171		_
Reverse Transfer Capacitance	C _{res}	1		16.7		
Total Gate Charge	Qg			174		nC
Gate-to-Emitter Charge	Q _{ge}	$V_{CE} = 600 \text{ V}, V_{GE} = 15 \text{ V},$ $I_{C} = 40 \text{ A}$		42.2		
Gate-to-Collector Charge	Q_{gc}			73		
SWITCHING CHARACTERISTICS						
Turn-on Delay Time	t _{d(on)}			37		ns
Turn-off Delay Time	t _{d(off)}			269		
Rise Time	t _r			22		
Fall Time	t _f	$V_{CE} = 600 \text{ V}, V_{GE} = 0/15 \text{ V},$ $I_{C} = 20 \text{ A R}_{G} = 4.7 \Omega, T_{J} = 25^{\circ}\text{C}$		136		
Turn-on Switching Loss	E _{on}	10 - 25 77 1g - 117 12, 15 - 20 0		1.2		mJ
Turn-off Switching Loss	E _{off}			1.4		1
Total Switching Loss	E _{ts}			2.6		
Turn-on Delay Time	t _{d(on)}	V_{CE} = 600 V, V_{GE} = 0/15 V, I_{C} = 40 A R_{G} = 4.7 Ω , T_{J} = 25°C		38		ns
Turn-off Delay Time	t _{d(off)}			184		
Rise Time	t _r			46		
Fall Time	t _f			134		
Turn-on Switching Loss	E _{on}			2.9		mJ
Turn-off Switching Loss	E _{off}			2.1		-
Total Switching Loss	E _{ts}			5.0		

ELECTRICAL CHARACTERISTICS OF IGBT ($T_J = 25^{\circ}C$ unless otherwise noted) (continued)

Parameter	Symbol	Test Conditions	Min	Тур	Max	Unit
SWITCHING CHARACTERISTICS	•					
Turn-on Delay Time	t _{d(on)}			34		ns
Turn-off Delay Time	t _{d(off)}			328		
Rise Time	t _r	V _{GE} = 0/15 V, I _C = 20 A,		24		
Fall Time	t _f	$V_{CF} = 600 \text{ V}, R_{G} = 4.7 \Omega,$		240		
Turn-on Switching Loss	E _{on}	T _J = 175°C		2.2		mJ
Turn-off Switching Loss	E _{off}			2.2		1
Total Switching Loss	E _{ts}			4.4		
Turn-on Delay Time	t _{d(on)}			38		ns
Turn-off Delay Time	t _{d(off)}			213		1
Rise Time	t _r	V ₀ = - 0/15 V ₁ I ₀ = 20 Δ		51		
Fall Time	t _f	V_{GE} = 0/15 V, I_{C} = 20 A, V_{CE} = 600 V, R_{G} = 4.7 Ω , T_{J} = 175°C		205		
Turn-on Switching Loss	E _{on}	I _J = 175°C		4.5		mJ
Turn-off Switching Loss	E _{off}			2.9		
Total Switching Loss	E _{ts}			7.4		
DIODE CHARACTERISTICS						
Forward Voltage	V _F	I _F = 40 A, T _J = 25°C	1.46	1.69	2.08	V
		I _F = 40 A, T _J = 175°C		1.63		
DIODE SWITCHING CHARACTERISTICS	S, INDUCTIVE LOAD)				
Reverse Recovery Time	t _{rr}			163		ns
Reverse Recovery Charge	Q _{rr}	V _R = 600 V, I _F = 20 A,		1462		nC
Reverse Recovery Energy	E _{REC}	$dI_F/dt = 500 \text{ A/}\mu\text{s}, T_J = 25^{\circ}\text{C}$		0.5		mJ
Peak Reverse Recovery Current	I _{RRM}			17.9		Α
Reverse Recovery Time	t _{rr}			248		ns
Reverse Recovery Charge	Q _{rr}	V _R = 600 V, I _F = 40 A,		2372		nC
Reverse Recovery Energy	E _{REC}	dl _F /dt = 500 A/μs, T _J = 25°C		0.8		mJ
Peak Reverse Recovery Current	I _{RRM}			19.2		Α
Reverse Recovery Time	t _{rr}			269		ns
Reverse Recovery Charge	Q _{rr}	V _R = 600 V, I _F = 20 A,		3447		nC
Reverse Recovery Energy	E _{REC}	$dI_F/dt = 500 \text{ A/}\mu\text{s}, T_J = 175^{\circ}\text{C}$		1.3		mJ
Peak Reverse Recovery Current	I _{RRM}			25.6		Α
Reverse Recovery Time	t _{rr}			422		ns
Reverse Recovery Charge	Q _{rr}	V _R = 600 V, I _F = 40 A,		5717		nC
Reverse Recovery Energy	E _{REC}	dl _F /dt = 500 A/μs, T _J = 175°C		2.3		mJ
Peak Reverse Recovery Current	I _{RRM}			27.1		Α

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

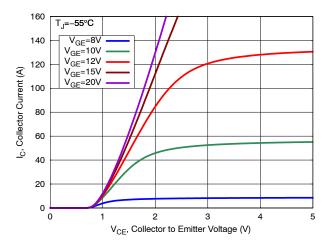


Figure 1. Output Characteristics

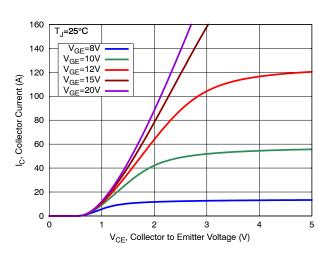


Figure 2. Output Characteristics

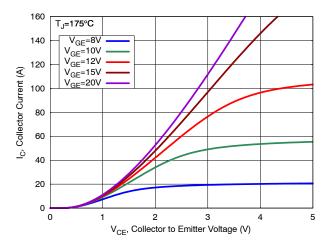


Figure 3. Output Characteristics

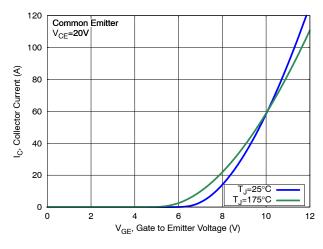


Figure 4. Transfer Characteristics

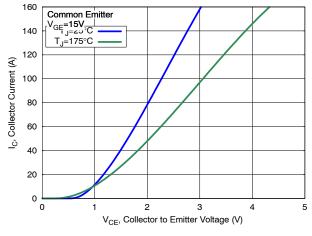


Figure 5. Saturation Characteristics

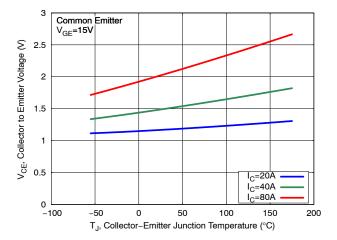
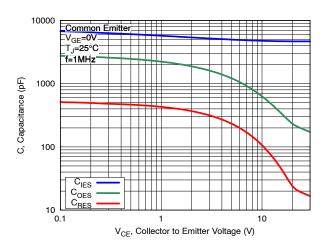


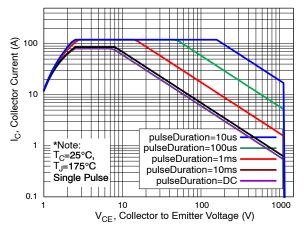
Figure 6. Saturation Voltage vs. Junction Temperature



Common Emitter 14 I_C=40A \mathbb{S} 12 V_{GE}, Gate to Emitter Voltage 10 8 6 V_{CC}=200V 2 V_{CC}=400V V_{CC}=600V 0 0 20 40 60 80 100 120 140 160 200 Q_G, Gate Charge (nC)

Figure 7. Capacitance Characteristics

Figure 8. Gate Charge Characteristics



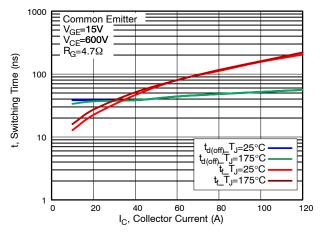
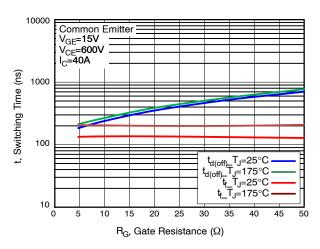


Figure 9. SOA Characteristics

Figure 10. Turn-On Switching Time vs Collector Current



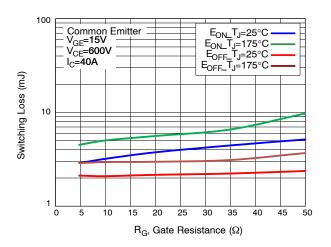
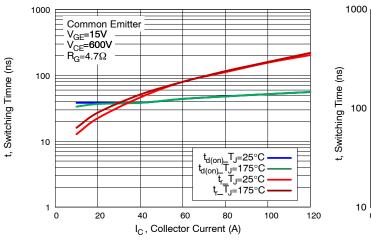


Figure 11. Turn-Off Switching Time vs. Gate Resistance

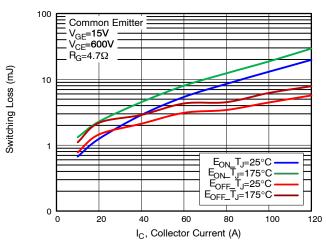
Figure 12. Switching Loss vs. Gate Resistance



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Figure 13. Turn-On Switching Time vs. Collector Current

Figure 14. Turn-Off Switching Time vs. Collector Current



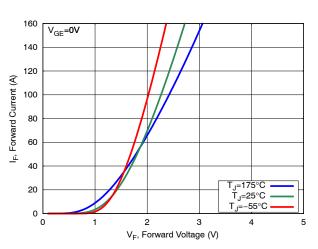
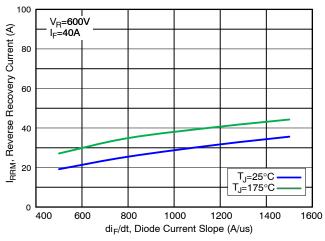


Figure 15. Switching Loss vs. Collector Current

Figure 16. Diode Forward Characteristics



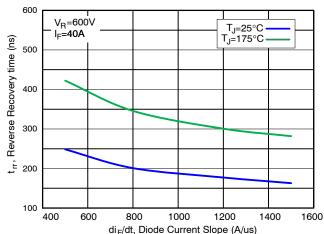


Figure 17. Diode Reverse Recovery Current

Figure 18. Diode Reverse Recovery Time

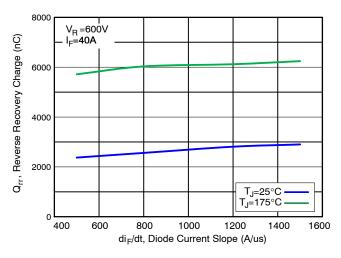


Figure 19. Diode Stored Charge Characteristics

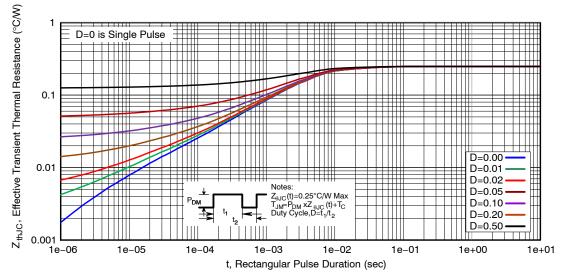


Figure 20. Transient Thermal Impedance of IGBT

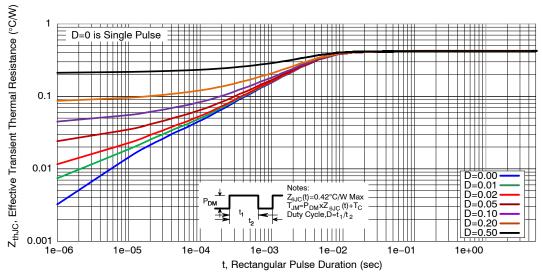
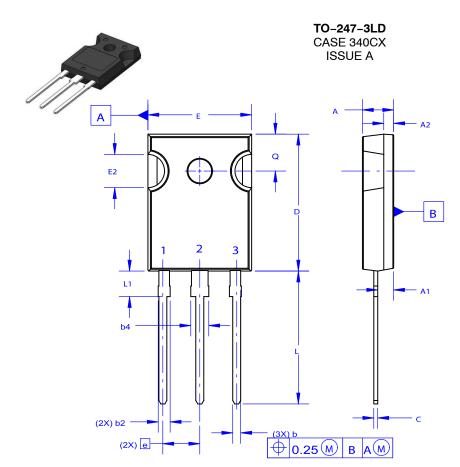
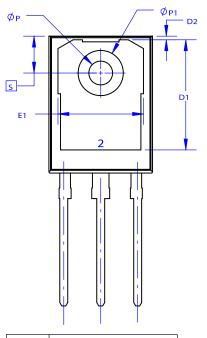


Figure 21. Transient Thermal Impedance of Diode



DATE 06 JUL 2020



NOTES: UNLESS OTHERWISE SPECIFIED.

- A. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

 B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DRAWING CONFORMS TO ASME Y14.5 2009.
- D. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.
- E. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.

GENERIC MARKING DIAGRAM*



XXXXX = Specific Device Code = Assembly Location

= Year WW = Work Week G = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot " =", may or may not be present. Some products may not follow the Generic Marking.

DIM	MILLIMETERS				
DIM	MIN	NOM	MAX		
Α	4.58	4.70	4.82		
A 1	2.20	2.40	2.60		
A2	1.40	1.50	1.60		
D	20.32	20.57	20.82		
Е	15.37	15.62	15.87		
E2	4.96	5.08	5.20		
е	~	5.56	~		
L	19.75	20.00	20.25		
L1	3.69	3.81	3.93		
ØΡ	3.51	3.58	3.65		
Q	5.34	5.46	5.58		
S	5.34	5.46	5.58		
b	1.17	1.26	1.35		
b2	1.53	1.65	1.77		
b4	2.42	2.54	2.66		
С	0.51	0.61	0.71		
D1	13.08	~	~		
D2	0.51	0.93	1.35		
E1	12.81	~	~		
ØP1	6.60	6.80	7.00		

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