# onsemi

# IGBT – Power, Single N-Channel, Field Stop VII (FS7), SCR, TO247-4L 1200 V, 1.66 V, 60 A

# AFGH4L60T120RW-STD

#### Description

Using the novel field stop 7th generation IGBT technology in TO247 4–lead package, this device offers good performance with low on state voltage and low switching losses for both hard and soft switching topologies in automotive applications.

#### Features

- Extremely Efficient Trench with Field Stop Technology
- Maximum Junction Temperature  $T_J = 175^{\circ}C$
- Short Circuit Rated and Low Saturation Voltage
- Fast Switching and Tightened Parameter Distribution
- AEC-Q101 Qualified, PPAP Available Upon Request
- This Device is Pb–Free, Halogen Free/BFR Free and is RoHS Compliant

#### Applications

• Automotive E-compressor / Automotive EV PTC Heater / OBC

#### MAXIMUM RATINGS (T<sub>J</sub> = 25°C unless otherwise noted)

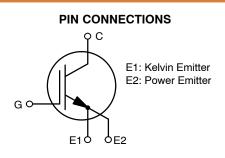
Param	Symbol	Value	Unit		
Collector-to-Emitter Volta	Collector-to-Emitter Voltage		1200	V	
Gate-to-Emitter Voltage		V <sub>GE</sub>	±20		
Transient Gate-to-Emitte	r Voltage	1	±30		
Collector Current	Collector Current $T_{C} = 25^{\circ}C$ (Note 1)			А	
	T <sub>C</sub> = 100°C				
Power Dissipation	Power Dissipation $T_{C} = 25^{\circ}C$		289	W	
$T_{\rm C} = 100^{\circ}{\rm C}$			134		
Pulsed Collector Current	$T_C = 25^{\circ}C$ (Note 2)	I <sub>CM</sub>	180	А	
Short Circuit Withstand Time V <sub>GE</sub> = 15 V, V <sub>CC</sub> = 800 V, T <sub>C</sub> = 150°C		T <sub>SC</sub>	6	μs	
Operating Junction and Storage Temperature Range		T <sub>J</sub> , T <sub>stg</sub>	– 55 to +175	°C	
Lead Temperature for Soldering Purposes		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.

1. Value limit by bond wire

2. Repetitive rating: Pulse width limited by max. junction temperature

BV <sub>CES</sub>	V <sub>CE(sat)</sub> TYP	I <sub>C</sub> MAX
1200 V	1.66 V	60 A





## MARKING DIAGRAM





- &Z = Assembly Plant Code
- &3 = 3-Digit Date Code
- &K = 2-Digit Lot Traceability Code

AFGH4L60120RWSTD = Specific Device Code

#### **ORDERING INFORMATION**

Device	Package	Shipping
AFGH4L60T120RW-STD	TO-247-4L (Pb-Free)	30 Units / Tube

#### THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case for IGBT	$R_{\theta JC}$	0.26	°C/W
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	40	

#### **ELECTRICAL CHARACTERISTICS** ( $T_J = 25^{\circ}C$ unless otherwise specified)

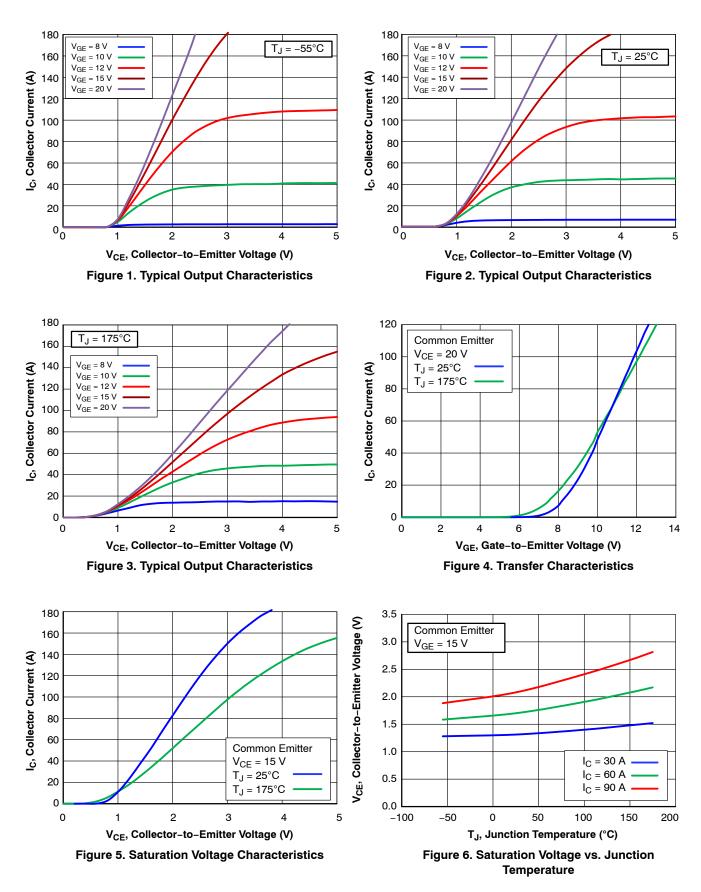
Parameter	Symbol	Test Conditions	Min	Тур	Max	Unit
OFF CHARACTERISTICS		•				
Collector-to-Emitter Breakdown Voltage	BV <sub>CES</sub>	$V_{GE}$ = 0 V, I <sub>C</sub> = 1 mA	1200	_	-	V
Collector-to-Emitter Cut-Off Current	I <sub>CES</sub>	$V_{GE}$ = 0 V, $V_{CE}$ = $V_{CES}$	-	-	40	μA
Gate-to-Emitter Leakage Current	I <sub>GES</sub>	$V_{GE}$ = ±20 V, $V_{CE}$ = 0 V	-	-	±400	nA
ON CHARACTERISTICS						
Gate-to-Emitter Threshold Voltage	V <sub>GE(th)</sub>	$V_{GE} = V_{CE}, I_C = 60 \text{ mA}$	5.1	6	6.9	V
Collector-to-Emitter Saturation	V <sub>CE(sat)</sub>	$V_{GE}$ = 15 V, I <sub>C</sub> = 60 A, T <sub>J</sub> = 25°C	-	1.66	1.99	V
Voltage		$V_{GE}$ = 15 V, I <sub>C</sub> = 60 A, T <sub>J</sub> = 175°C	-	2.14	-	
DYNAMIC CHARACTERISTICS						
Input Capacitance	C <sub>IES</sub>	$V_{CE}$ = 30 V, $V_{GE}$ = 0 V, f = 1 MHz	-	5330	-	pF
Output Capacitance	C <sub>OES</sub>	]	-	114	-	1
Reverse Transfer Capacitance	C <sub>RES</sub>		-	23	-	
Total Gate Charge	Q <sub>G</sub>	$V_{CE}$ = 600 V, $V_{GE}$ = 15 V, $I_{C}$ = 60 A	-	174	-	nC
Gate-to-Emitter Charge	Q <sub>GE</sub>		-	52	-	
Gate-to-Collector Charge	Q <sub>GC</sub>		-	73.6	-	
SWITCHING CHARACTERISTICS, INC	DUCTIVE LOAI	D (Note: Si Diode Applied)				
Turn-On Delay Time	t <sub>d(on)</sub>	$V_{CE} = 600 \text{ V}, \text{ V}_{GE} = 15 \text{ V},$	-	62	-	ns
Rise Time	t <sub>r</sub>	$I_{\rm C} = 30 \text{ A}, \text{ R}_{\rm G} = 6 \Omega,$ $T_{\rm J} = 25^{\circ} \text{C}$	-	26	-	
Turn-Off Delay Time	t <sub>d(off)</sub>		-	305	-	1
Fall Time	t <sub>f</sub>		-	207	-	
Turn-On Switching Loss	Eon		-	1.48	-	mJ
Turn-Off Switching Loss	E <sub>off</sub>		-	2.32	-	
Total Switching Loss	E <sub>ts</sub>		-	3.8	-	
Turn-On Delay Time	t <sub>d(on)</sub>	$V_{CE} = 600 \text{ V}, \text{ V}_{GE} = 15 \text{ V}, \ \text{I}_{C} = 60 \text{ A}, \text{ R}_{G} = 6 \Omega,$	-	68	-	ns
Rise Time	t <sub>r</sub>	$I_{C} = 60 \text{ A}, \text{ H}_{G} = 6 \Omega, \\ T_{J} = 25^{\circ}\text{C}$	-	9	-	1
Turn-Off Delay Time	t <sub>d(off)</sub>	]	-	264	-	
Fall Time	t <sub>f</sub>	1	-	203	-	
Turn-On Switching Loss	E <sub>on</sub>	1	-	3.03	-	mJ
Turn-Off Switching Loss	E <sub>off</sub>	1	-	3.98	-	1
Total Switching Loss	E <sub>ts</sub>	1	-	7	_	

# **ELECTRICAL CHARACTERISTICS** (T<sub>J</sub> = $25^{\circ}$ C unless otherwise specified)

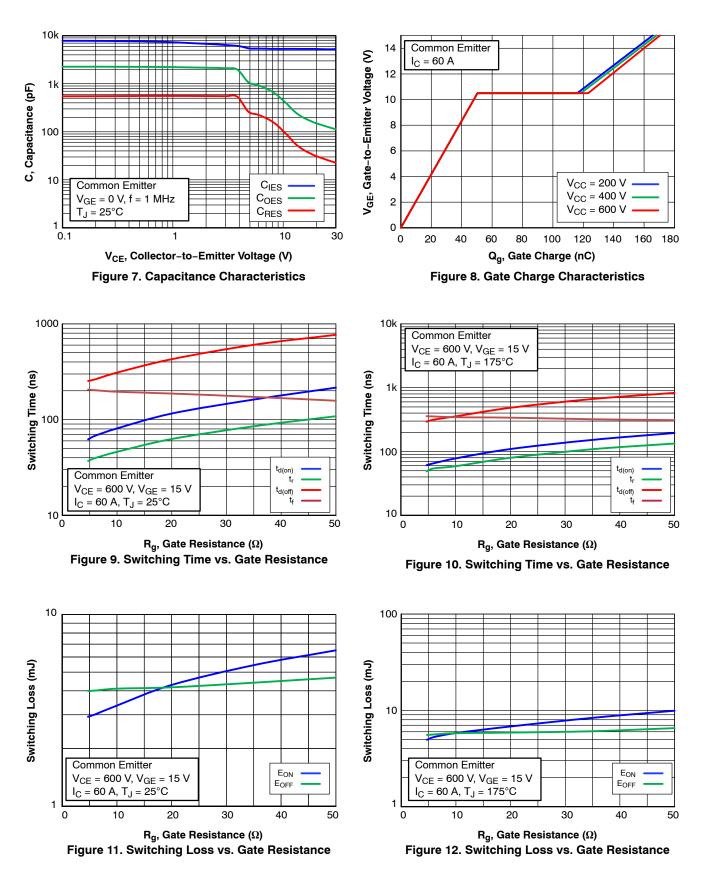
Parameter	Symbol	Test Conditions	Min	Тур	Max	Unit
SWITCHING CHARACTERISTICS	S, INDUCTIVE LOAD	(Note: Si Diode Applied)				
Turn-On Delay Time	t <sub>d(on)</sub>	$V_{CE} = 600 \text{ V}, \text{ V}_{GE} = 15 \text{ V},$	-	59	-	ns
Rise Time	t <sub>r</sub>	I <sub>C</sub> = 30 A, R <sub>G</sub> = 6 Ω, T <sub>J</sub> = 175°C	-	34	-	
Turn-Off Delay Time	t <sub>d(off)</sub>		-	347	-	
Fall Time	t <sub>f</sub>		-	349	-	
Turn–On Switching Loss	E <sub>on</sub>		-	2.68	-	mJ
Turn–Off Switching Loss	E <sub>off</sub>		-	3.03	-	
Total Switching Loss	E <sub>ts</sub>		-	5.7	-	
Turn-On Delay Time	t <sub>d(on)</sub>	$V_{CE} = 600 \text{ V}, V_{GE} = 15 \text{ V},$	-	67	-	ns
Rise Time	t <sub>r</sub>	I <sub>C</sub> = 60 A, R <sub>G</sub> = 6 Ω, T <sub>J</sub> = 175°C	-	52	-	
Turn-Off Delay Time	t <sub>d(off)</sub>		-	313	-	
Fall Time	t <sub>f</sub>		-	355	-	
Turn-On Switching Loss	E <sub>on</sub>		-	5.61	-	mJ
Turn–Off Switching Loss	E <sub>off</sub>		-	5.67	-	
Total Switching Loss	E <sub>ts</sub>		-	11.28	-	1

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.

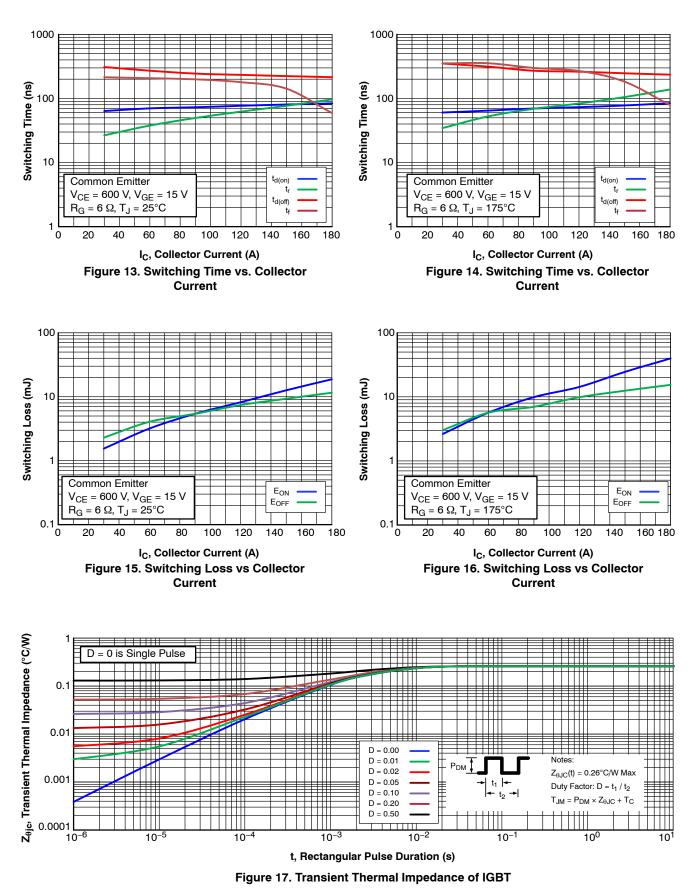
# **TYPICAL CHARACTERISTICS**



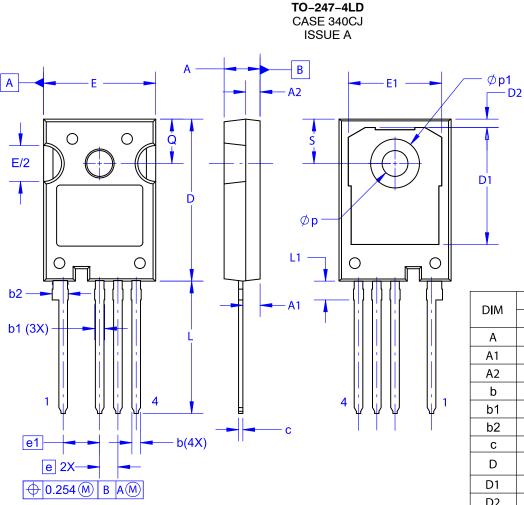
# **TYPICAL CHARACTERISTICS**



# **TYPICAL CHARACTERISTICS**



## PACKAGE DIMENSIONS



#### NOTES:

A. NO INDUSTRY STANDARD APPLIES TO THIS PACKAGE.
B. DIMENSIONS ARE EXCLUSIVE OF BURRS,MOLD FLASH,AND TIE BAR EXTRUSIONS.
C. ALL DIMENSIONS ARE IN MILLIMETERS.
D. DRAWING CONFORMS TO ASME Y14.5-2009.

DIM	MILLIMETERS			
DIM	MIN	NOM	MAX	
А	4.80	5.00	5.20	
A1	2.10	2.40	2.70	
A2	1.80	2.00	2.20	
b	1.07	1.20	1.33	
b1	1.20	1.40	1.60	
b2	2.02	2.22	2.42	
С	0.50	0.60	0.70	
D	22.34	22.54	22.74	
D1	16.00	16.25	16.50	
D2	0.97	1.17	1.37	
е	2.54 BSC			
e1	5	5.08 BSC	2	
E	15.40	15.60	15.80	
E1	12.80	13.00	13.20	
E/2	4.80	5.00	5.20	
L	18.22	18.42	18.62	
L1	2.42	2.62	2.82	
р	3.40	3.60	3.80	
p1	6.60	6.80	7.00	
Q	5.97	6.17	6.37	
S	5.97	6.17	6.37	

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