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Field Stop Trench IGBT

650 V, 75 A, TO247

AFGHL75T65SQ

Using the novel field stop 4th generation IGBT technology, AFGHL75T65SQ offers the optimum performance with both low conduction and switching losses for high efficiency operations in various applications, which does not require reverse recovery specification.

Features

- Maximum Junction Temperature: $T_J = 175^\circ\text{C}$
- Positive Temperature Co-efficient for Easy Parallel Operating
- High Current Capability
- Low Saturation Voltage: $V_{CE(Sat)} = 1.6\text{ V (Typ.) @ } I_C = 75\text{ A}$
- 100% of the Parts are Tested for I_{LM} (Note 2)
- Fast Switching
- Tight Parameter Distribution
- AEC-Q101 Qualified and PPAP Capable

Typical Applications

- Automotive
- On & Off Board Chargers
- DC-DC Converters
- PFC
- Industrial Inverter

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-to-Emitter Voltage	V_{CES}	650	V
Gate-to-Emitter Voltage Transient Gate-to-Emitter Voltage	V_{GES}	± 20 ± 30	V
Collector Current (Note 1)	I_C	80 75	A
		@ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$	
Pulsed Collector Current (Note 2)	I_{LM}	300	A
Pulsed Collector Current (Note 3)	I_{CM}	300	A
Maximum Power Dissipation	P_D	375 188	W
		@ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$	
Operating Junction / Storage Temperature Range	T_J , T_{STG}	-55 to +175	$^\circ\text{C}$
Maximum Lead Temp. for Soldering Purposes, 1/8" from case for 10 seconds	T_L	265	$^\circ\text{C}$

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.

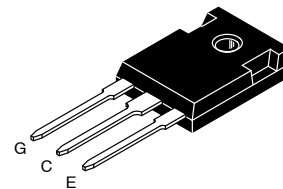
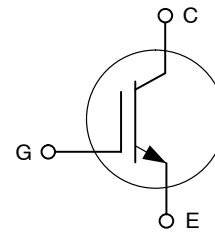
1. Value limited by bond wire
2. $V_{CC} = 400\text{ V}$, $V_{GE} = 15\text{ V}$, $I_C = 300\text{ A}$, $R_G = 15\ \Omega$, Inductive Load, 100% of the Parts are Tested.
3. Repetitive Rating: pulse width limited by max. Junction temperature



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75 A, 650 V
 $V_{CESat} = 1.6\text{ V (Typ.)}$



TO-247-3LD
CASE 340CX

MARKING DIAGRAM



A = Assembly Location
 YWW = 3-Digit Date Code
 ZZ = 2-Digit Lot Traceability Code
 AFGHL75T65SQ = Specific Device Code

ORDERING INFORMATION

Device	Package	Shipping
AFGHL75T65SQ	TO-247-3L	30 Units / Rail

AFGHL75T65SQ

THERMAL CHARACTERISTICS

Rating	Symbol	Max	Unit
Thermal resistance junction-to-case, for IGBT	$R_{\theta JC}$	0.4	$^{\circ}\text{C}/\text{W}$
Thermal resistance junction-to-ambient	$R_{\theta JA}$	40	$^{\circ}\text{C}/\text{W}$

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Collector-emitter breakdown voltage, gate-emitter short-circuited	$V_{GE} = 0\text{ V}$, $I_C = 1\text{ mA}$	BV_{CES}	650	-	-	V
Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0\text{ V}$, $I_C = 1\text{ mA}$	$\frac{\Delta BV_{CES}}{\Delta T_J}$	-	0.6	-	$\text{V}/^{\circ}\text{C}$
Collector-emitter cut-off current, gate-emitter short-circuited	$V_{GE} = 0\text{ V}$, $V_{CE} = 650\text{ V}$	I_{CES}	-	-	250	μA
Gate leakage current, collector-emitter short-circuited	$V_{GE} = 20\text{ V}$, $V_{CE} = 0\text{ V}$	I_{GES}	-	-	± 400	nA

ON CHARACTERISTICS

Gate-emitter threshold voltage	$V_{GE} = V_{CE}$, $I_C = 75\text{ mA}$	$V_{GE(th)}$	3.4	4.9	6.4	V
Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$, $I_C = 75\text{ A}$ $V_{GE} = 15\text{ V}$, $I_C = 75\text{ A}$, $T_J = 175^{\circ}\text{C}$	$V_{CE(sat)}$	-	1.6	2.1	V
			-	2.0	-	

DYNAMIC CHARACTERISTICS

Input capacitance	$V_{CE} = 30\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$	C_{ies}	-	4574	-	pF
Output capacitance		C_{oes}	-	289.4	-	
Reverse transfer capacitance		C_{res}	-	11.2	-	
Gate charge total	$V_{CE} = 400\text{ V}$, $I_C = 75\text{ A}$, $V_{GE} = 15\text{ V}$	Q_g	-	139	-	nC
Gate-to-emitter charge		Q_{ge}	-	25	-	
Gate-to-collector charge		Q_{gc}	-	33	-	

SWITCHING CHARACTERISTICS, INDUCTIVE LOAD

Turn-on delay time	$T_C = 25^{\circ}\text{C}$, $V_{CC} = 400\text{ V}$, $I_C = 37.5\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GE} = 15\text{ V}$, Inductive Load Energy losses include "tail" and diode reverse recovery. Diode from AFGHL75T65SQD.	$t_{d(on)}$	-	23	-	ns
Rise time		t_r	-	17	-	
Turn-off delay time		$t_{d(off)}$	-	112	-	
Fall time		t_f	-	8	-	
Turn-on switching loss		E_{on}	-	0.61	-	mJ
Turn-off switching loss		E_{off}	-	0.21	-	
Total switching loss		E_{ts}	-	0.82	-	
Turn-on delay time	$T_C = 25^{\circ}\text{C}$, $V_{CC} = 400\text{ V}$, $I_C = 75\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GE} = 15\text{ V}$, Inductive Load Energy losses include "tail" and diode reverse recovery. Diode from AFGHL75T65SQD.	$t_{d(on)}$	-	25	-	ns
Rise time		t_r	-	46	-	
Turn-off delay time		$t_{d(off)}$	-	106	-	
Fall time		t_f	-	67	-	
Turn-on switching loss		E_{on}	-	1.86	-	mJ
Turn-off switching loss		E_{off}	-	1.13	-	
Total switching loss		E_{ts}	-	2.99	-	

AFGHL75T65SQ

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
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SWITCHING CHARACTERISTICS, INDUCTIVE LOAD

Turn-on delay time	$T_C = 175^\circ\text{C}$, $V_{CC} = 400\text{ V}$, $I_C = 37.5\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GE} = 15\text{ V}$, Inductive Load Energy losses include "tail" and diode reverse recovery. Diode from AFGHL75T65SQD.	$t_{d(on)}$	-	21	-	ns
Rise time		t_r	-	19	-	
Turn-off delay time		$t_{d(off)}$	-	126	-	
Fall time		t_f	-	7	-	
Turn-on switching loss		E_{on}	-	1.20	-	mJ
Turn-off switching loss		E_{off}	-	0.41	-	
Total switching loss		E_{ts}	-	1.61	-	
Turn-on delay time	$T_C = 175^\circ\text{C}$, $V_{CC} = 400\text{ V}$, $I_C = 75\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GE} = 15\text{ V}$, Inductive Load Energy losses include "tail" and diode reverse recovery. Diode from AFGHL75T65SQD.	$t_{d(on)}$	-	24	-	ns
Rise time		t_r	-	46	-	
Turn-off delay time		$t_{d(off)}$	-	115	-	
Fall time		t_f	-	72	-	
Turn-on switching loss		E_{on}	-	2.84	-	mJ
Turn-off switching loss		E_{off}	-	1.35	-	
Total switching loss		E_{ts}	-	4.20	-	

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.

AFGHL75T65SQ

TYPICAL CHARACTERISTICS

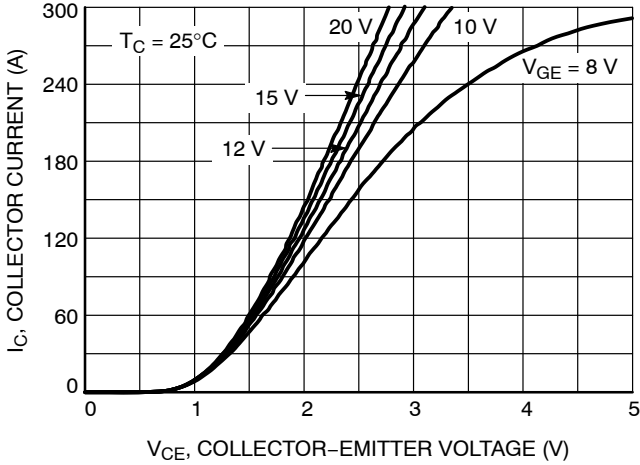


Figure 1. Typical Output Characteristics
($T_c = 25^\circ\text{C}$)

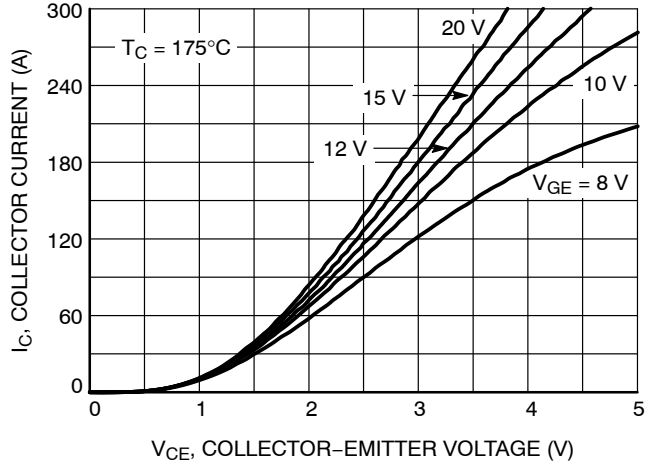


Figure 2. Typical Output Characteristics
($T_c = 175^\circ\text{C}$)

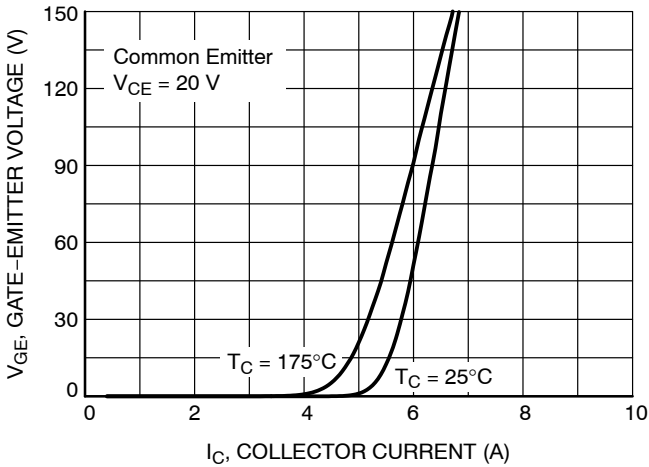


Figure 3. Transfer Characteristics

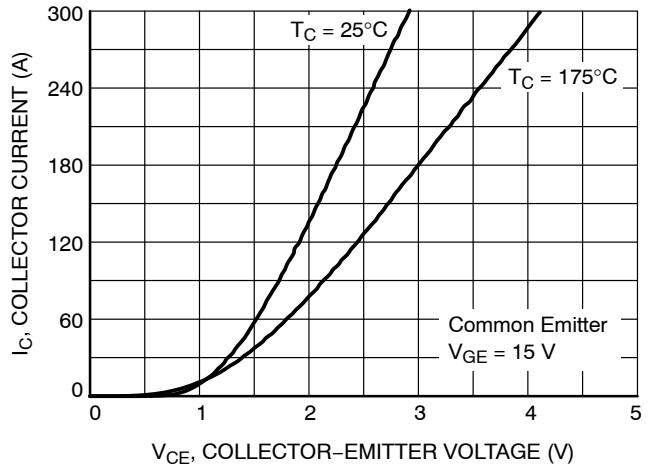


Figure 4. Typical Saturation Voltage
Characteristics

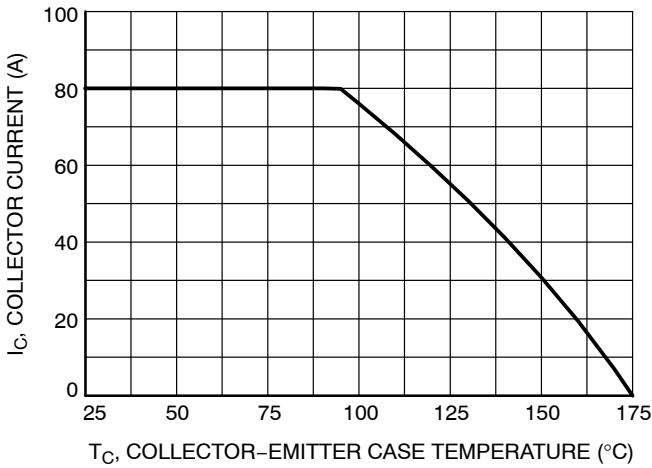


Figure 5. Collector Current Derating

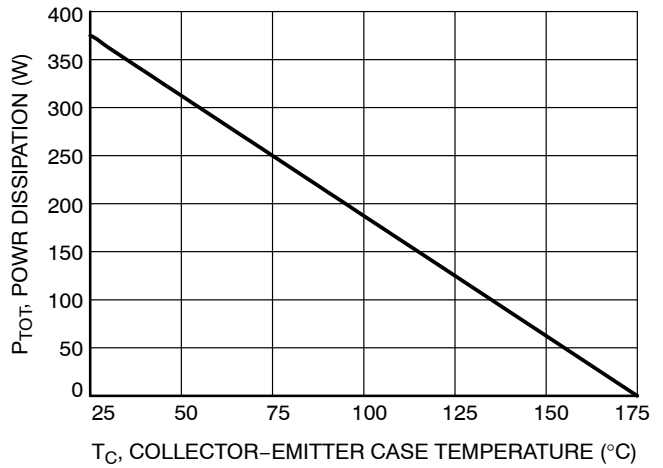


Figure 6. Power Dissipation

TYPICAL CHARACTERISTICS

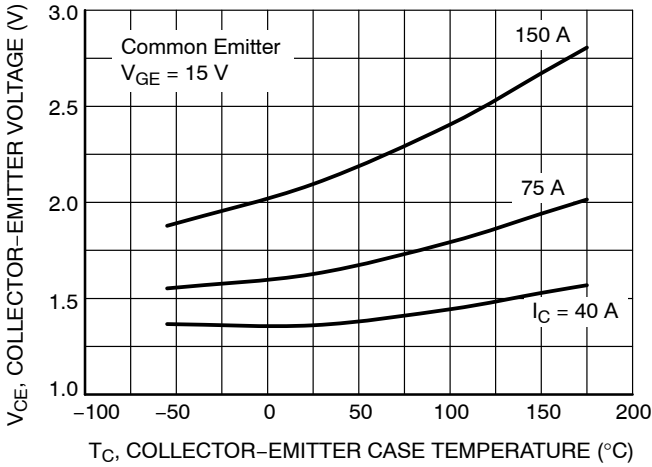


Figure 7. Saturation Voltage vs. Case Temperature at Variant Current Level

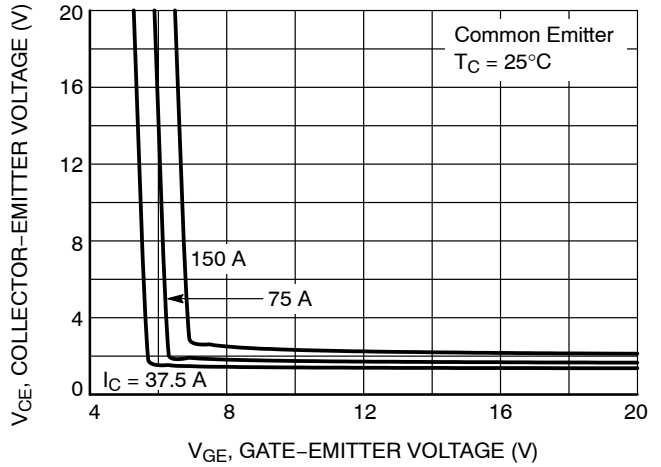


Figure 8. Saturation Voltage vs. V_{GE} (T_C = 25°C)

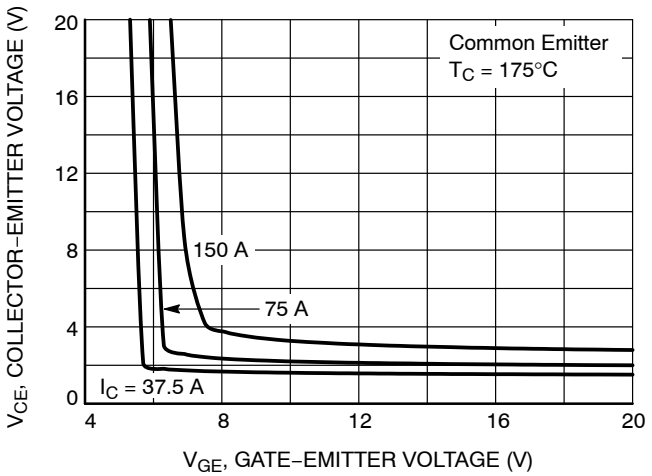


Figure 9. Saturation Voltage vs. V_{GE} (T_C = 175°C)

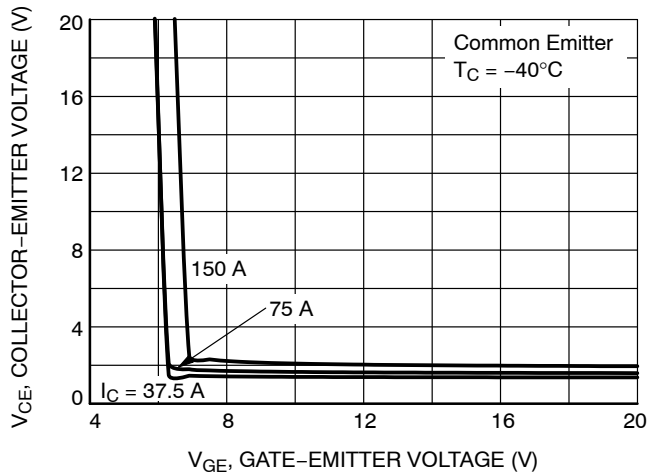


Figure 10. Saturation Voltage vs. V_{GE} (T_C = -40°C)

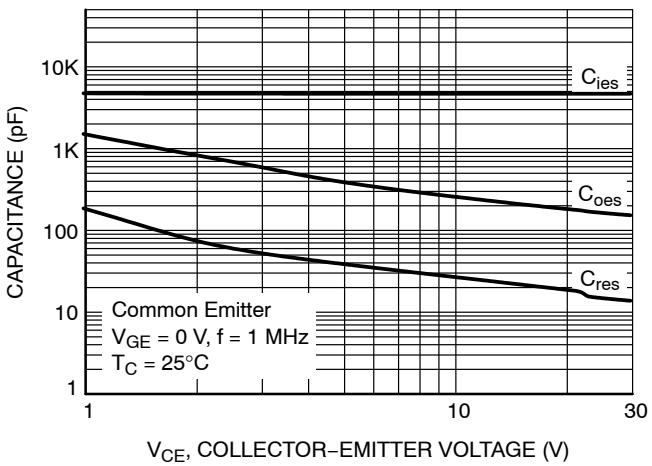


Figure 11. Capacitance Characteristics

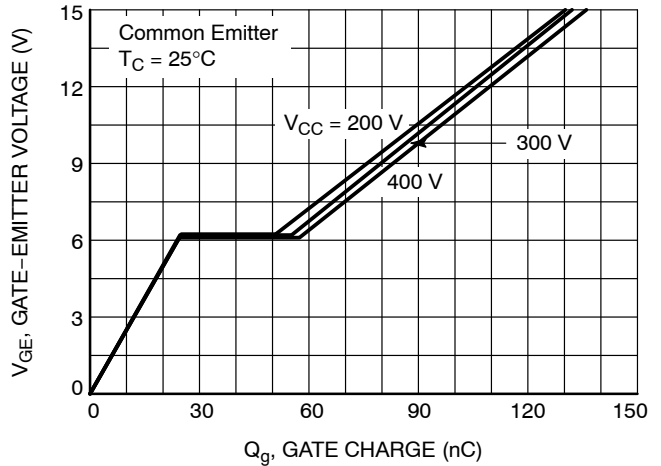


Figure 12. Gate Charge Characteristic (T_C = 25°C)

TYPICAL CHARACTERISTICS

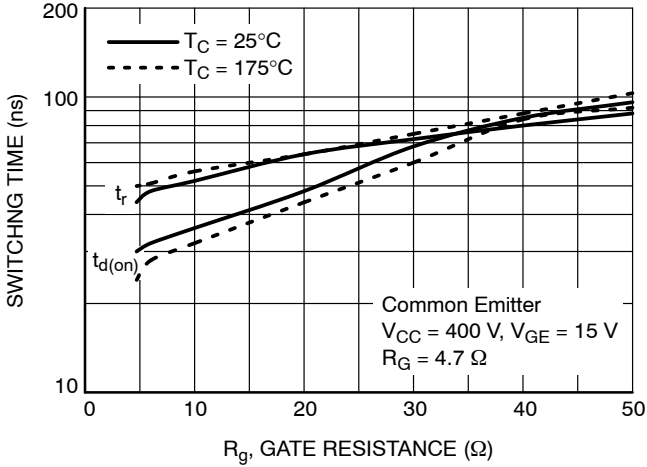


Figure 13. Turn-On Characteristics vs. Gate Resistance

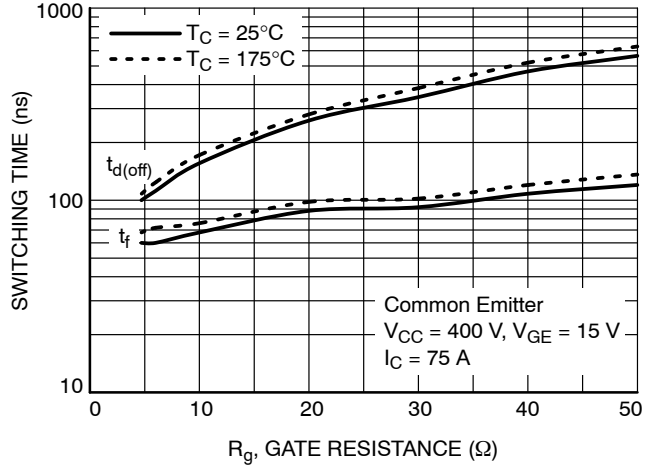


Figure 14. Turn-Off Characteristics vs. Gate Resistance

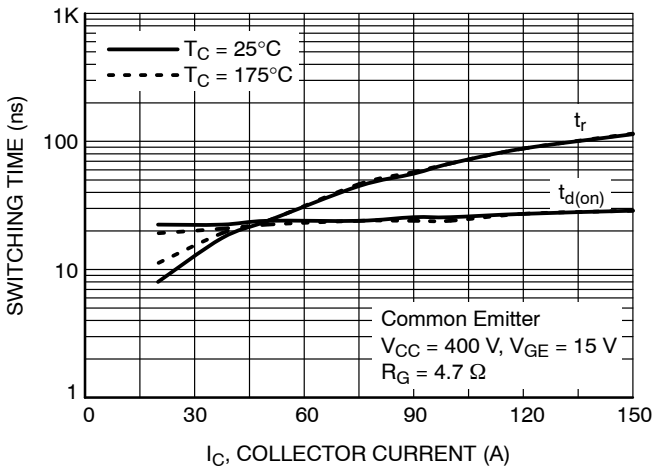


Figure 15. Turn-On Characteristics vs. Collector Current

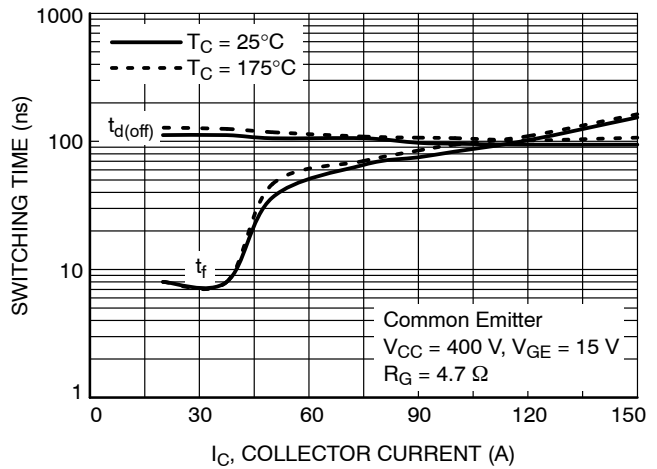


Figure 16. Turn-Off Characteristics vs. Collector Current

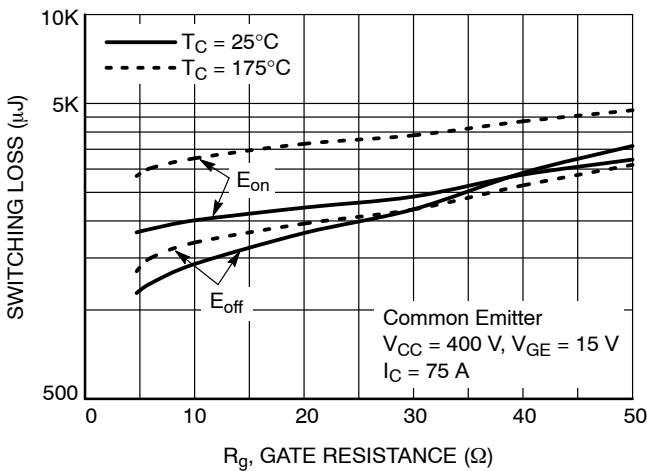


Figure 17. Switching Loss vs. Gate Resistance

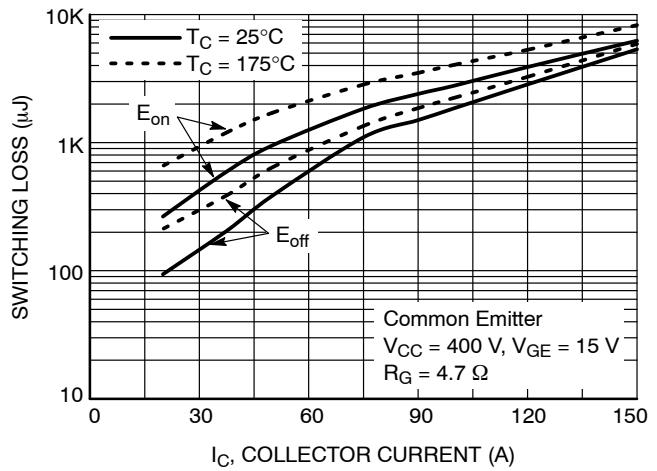


Figure 18. Switching Loss vs. Collector Current

AFGHL75T65SQ

TYPICAL CHARACTERISTICS

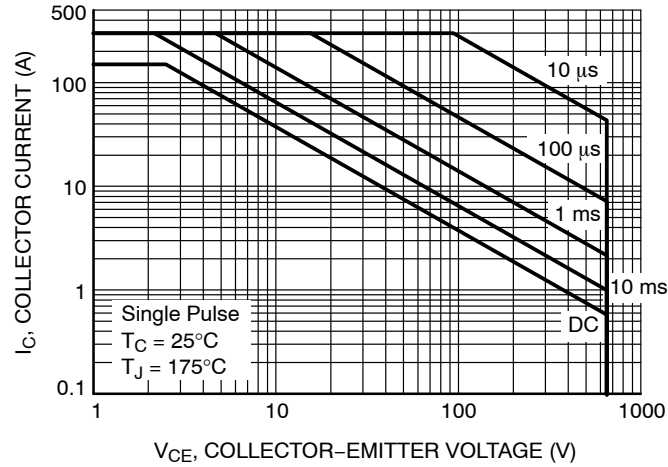


Figure 19. SOA Characteristics (FBSOA)

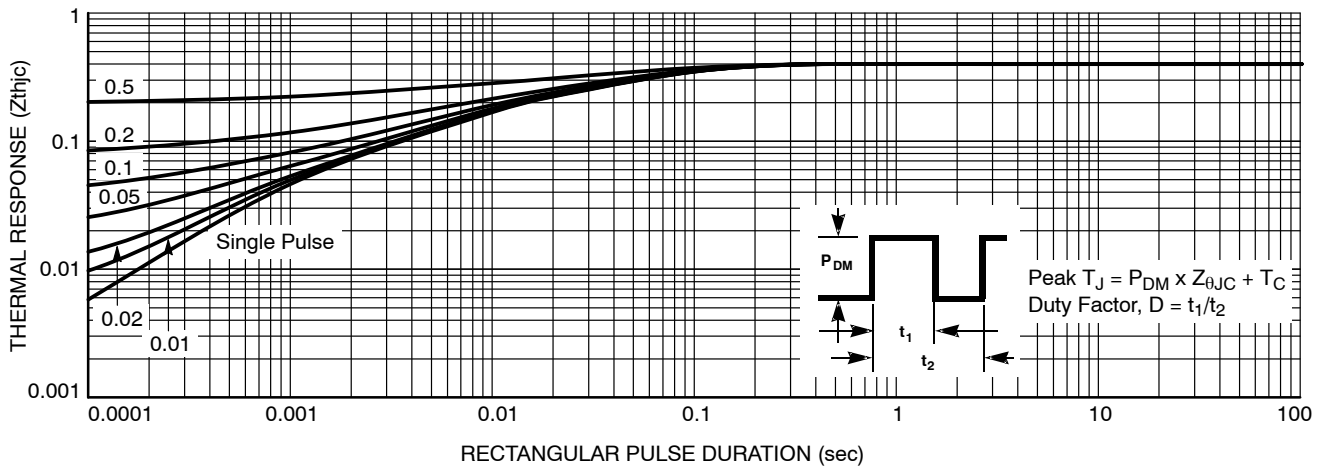
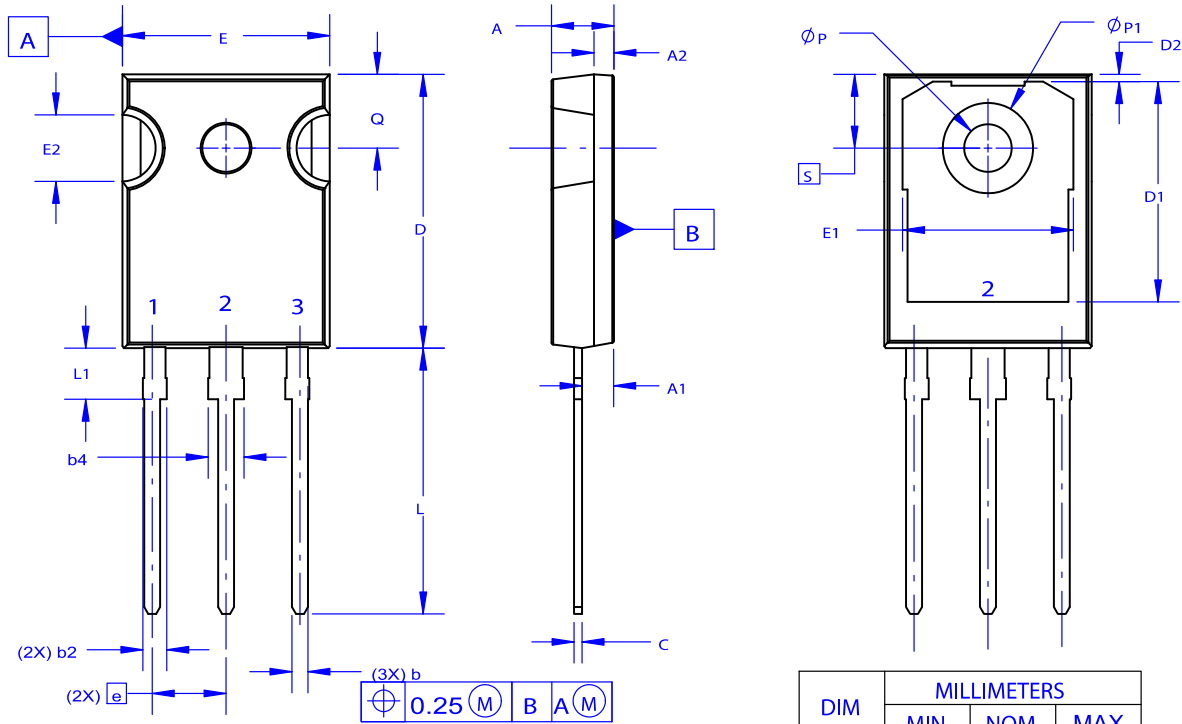


Figure 20. Transient Thermal Impedance of IGBT

AFGHL75T65SQ

PACKAGE DIMENSIONS

TO-247-3LD
CASE 340CX
ISSUE O



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.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.58	4.70	4.82
A1	2.20	2.40	2.60
A2	1.40	1.50	1.60
D	20.32	20.57	20.82
E	15.37	15.62	15.87
E2	4.96	5.08	5.20
e	~	5.56	~
L	19.75	20.00	20.25
L1	3.69	3.81	3.93
ϕ P	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
c	0.51	0.61	0.71
D1	13.08	~	~
D2	0.51	0.93	1.35
E1	12.81	~	~
ϕ P1	6.60	6.80	7.00