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DATA SHEET
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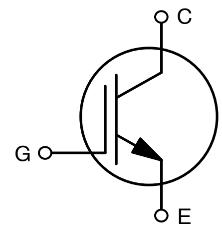
IGBT – Power, Single N-Channel, Field Stop VII (FS7), SCR, Power TO247-3L

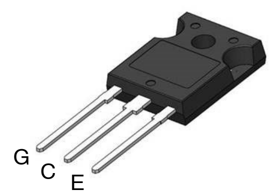
1200 V, 1.42 V, 40 A

AFGHL40T120RW

BV_{CES}	$V_{CE(sat)}$ TYP	I_C MAX
1200 V	1.42 V	40 A

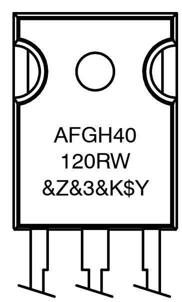
PIN CONNECTIONS





TO−247−3LD
CASE 340CX

MARKING DIAGRAM



AFGH40120RW = Specific Device Code
&Z = Assembly Plant Code
&3 = 3−Digit Date Code
&K = 2−Digit Lot Traceability Code
$Y = **onsemi** Logo

ORDERING INFORMATION

Device	Package	Shipping
AFGHL40T120RW	TO−247−3L (Pb−Free)	30 Units / Tube

Description

Using the novel field stop 7th generation IGBT technology in TO247 3−lead package, this device offers the optimum performance with low on state voltage and minimal 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°C
- Short Circuit Rated / Low Saturation Voltage
- Fast Switching / Tightened Parameter Distribution
- AEC−Q101 Qualified, PPAP Available Upon Request
- This Device is Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

Applications

- Automotive E−compressor
- Automotive EV PTC Heater
- OBC

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Parameter		Symbol	Value	Unit
Collector−to−Emitter Voltage		V_{CE}	1200	V
Gate−to−Emitter Voltage		V_{GE}	±20	
Transient Gate−to−Emitter Voltage			±30	
Collector Current	T_C = 25°C	I_C	80	A
	T_C = 100°C		40	
Power Dissipation	T_C = 25°C	P_D	576	W
	T_C = 100°C		288	
Pulsed Collector Current	T_C = 25°C, t_p = 10 μs (Note 1)	I_{CM}	120	A
Short Circuit Withstand Time V_{GE} = 15 V, V_{CC} = 800 V, T_C = 150°C		T_{SC}	6	μs
Operating Junction and Storage Temperature Range		T_J, T_{stg}	−55 to +175	°C
Lead Temperature for Soldering Purposes		T_L	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. Repetitive rating: Pulse width limited by max. junction temperature

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°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector−to−Emitter Breakdown Voltage	BV_{CES}	V_{GE} = 0 V, I_C = 5 mA	1200	–	–	V
Zero Gate Voltage Collector Current	I_{CES}	V_{GE} = 0 V, V_{CE} = V_{CES}	–	–	40	μA
Gate−to−Emitter Leakage Current	I_{GES}	V_{GE} = ±20 V, V_{CE} = 0 V	–	–	±400	nA
ON CHARACTERISTICS						
Gate−to−Emitter Threshold Voltage	$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 40 mA	5.03	5.93	6.83	V
Collector−to−Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE} = 15 V, I_C = 40 A, T_J = 25°C	–	1.42	1.75	V
		V_{GE} = 15 V, I_C = 40 A, T_J = 175°C	–	1.68	–	
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{IES}	V_{CE} = 30 V, V_{GE} = 0 V, f = 1 MHz	–	4717	–	pF
Output Capacitance	C_{OES}		–	144	–	
Reverse Transfer Capacitance	C_{RES}		–	24.5	–	
Total Gate Charge	Q_G	V_{CE} = 600 V, V_{GE} = 15 V, I_C = 40 A	–	171	–	nC
Gate−to−Emitter Charge	Q_{GE}		–	42.2	–	
Gate−to−Collector Charge	Q_{GC}		–	73.7	–	
SWITCHING CHARACTERISTICS, INDUCTIVE LOAD (Note: Si Diode Applied)						
Turn−On Delay Time	$t_{d(on)}$	V_{CE} = 600 V V_{GE} = 0/15 V I_C = 20 A R_G = 4.7 Ω T_J = 25°C	–	50.1	–	ns
Turn−Off Delay Time	$t_{d(off)}$		–	293	–	
Rise Time	t_r		–	30.9	–	
Fall Time	t_f		–	189	–	
Turn−On Switching Loss	E_{on}		–	1.37	–	mJ
Turn−Off Switching Loss	E_{off}		–	1.35	–	
Total Switching Loss	E_{ts}		–	2.72	–	
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	–	55.2	–	ns
Turn−Off Delay Time	$t_{d(off)}$		–	241	–	
Rise Time	t_r		–	55.2	–	
Fall Time	t_f		–	122	–	
Turn−On Switching Loss	E_{on}		–	3.68	–	mJ
Turn−Off Switching Loss	E_{off}		–	1.7	–	
Total Switching Loss	E_{ts}		–	5.38	–	

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise specified) (continued)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS, INDUCTIVE LOAD (Note: Si Diode Applied)						
Turn−On Delay Time	$t_{d(on)}$	V_{CE} = 600 V V_{GE} = 0/15 V I_C = 20 A R_G = 4.7 Ω T_J = 175°C	–	56	–	ns
Turn−Off Delay Time	$t_{d(off)}$		–	414	–	
Rise Time	t_r		–	41.7	–	
Fall Time	t_f		–	375	–	
Turn−On Switching Loss	E_{on}		–	2.13	–	mJ
Turn−Off Switching Loss	E_{off}		–	2.51	–	
Total Switching Loss	E_{ts}		–	4.64	–	
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 = 175°C	–	63.1	–	ns
Turn−Off Delay Time	$t_{d(off)}$		–	325	–	
Rise Time	t_r		–	71.2	–	
Fall Time	t_f		–	233	–	
Turn−On Switching Loss	E_{on}		–	5.75	–	mJ
Turn−Off Switching Loss	E_{off}		–	3.03	–	
Total Switching Loss	E_{ts}		–	8.79	–	

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

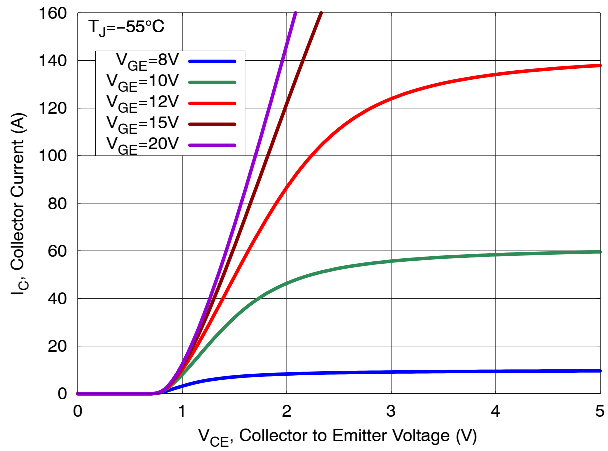


Figure 1. Output Characteristics

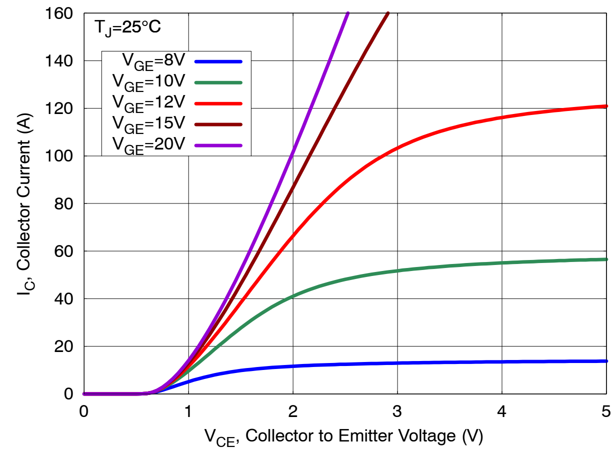


Figure 2. Output Characteristics

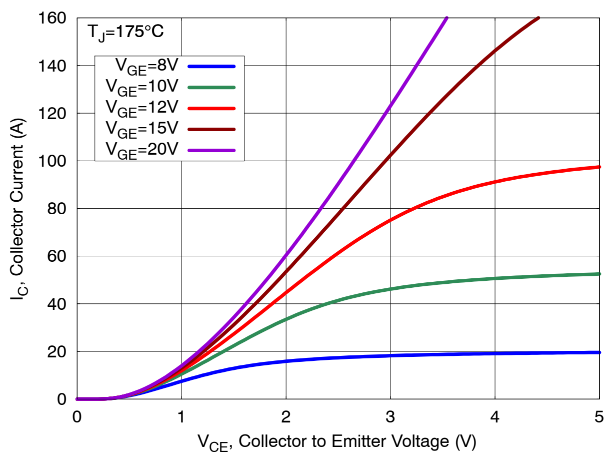


Figure 3. Output Characteristics

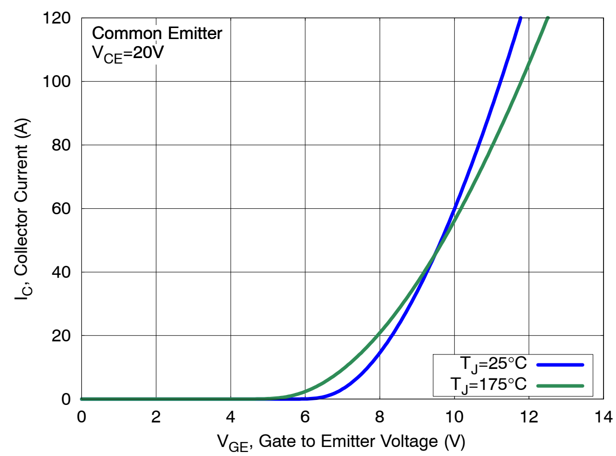


Figure 4. Transfer Characteristics

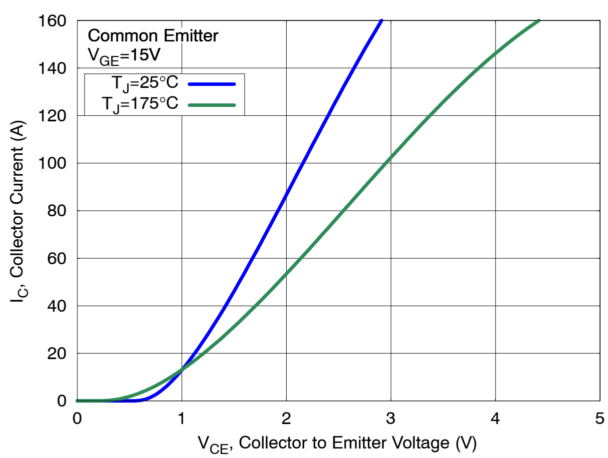


Figure 5. Saturation Characteristics

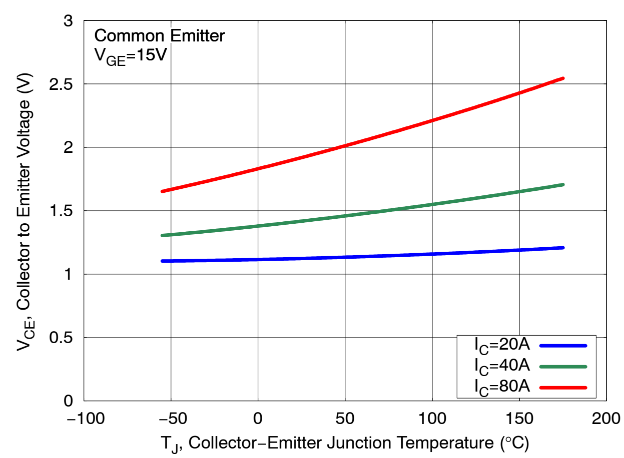


Figure 6. Saturation Voltage vs Junction Temperature

TYPICAL CHARACTERISTICS

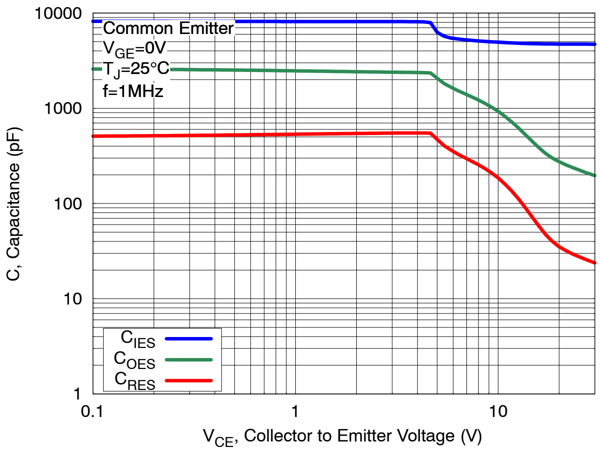


Figure 7. Capacitance Characteristics

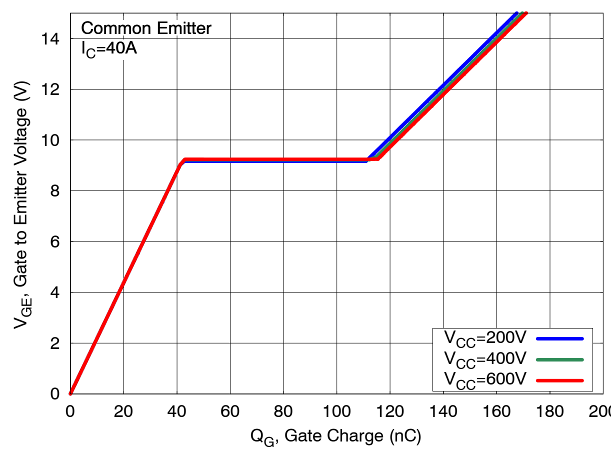


Figure 8. Gate Charge Characteristics

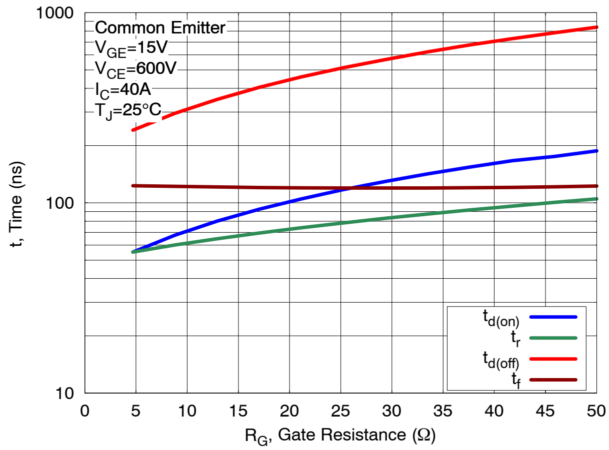


Figure 9. Switching Time vs Gate Resistance

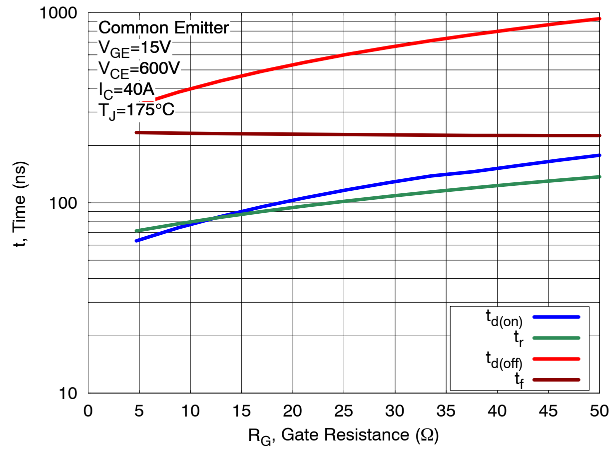


Figure 10. Switching Time vs Gate Resistance

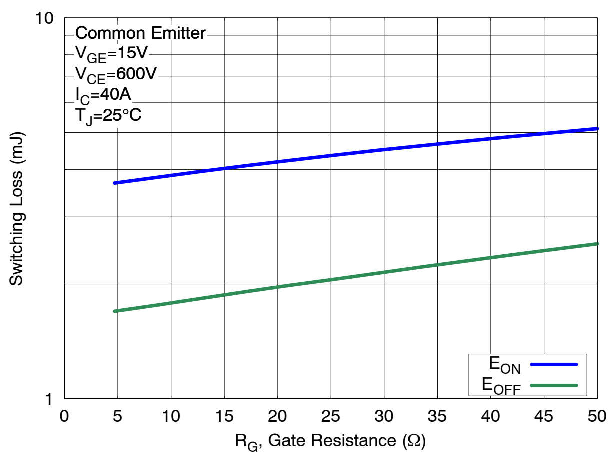


Figure 11. Switching Loss vs Gate Resistance

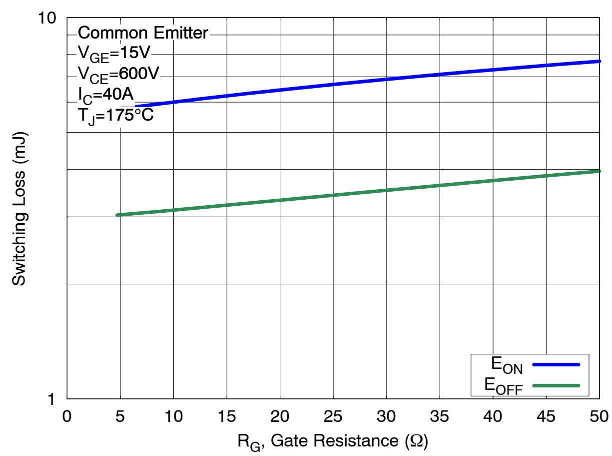


Figure 12. Switching Loss vs Gate Resistance

TYPICAL CHARACTERISTICS

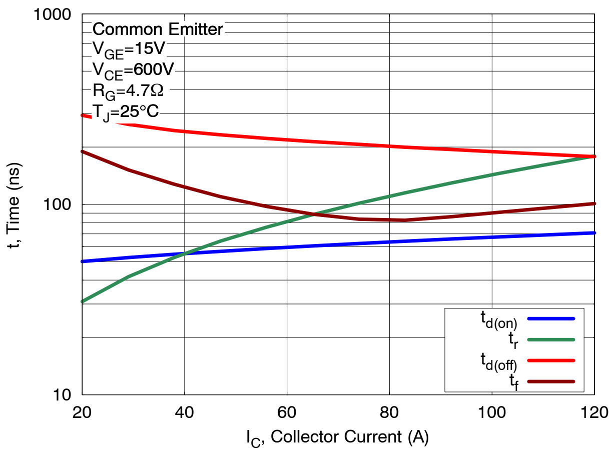


Figure 13. Switching Time vs Collector Current

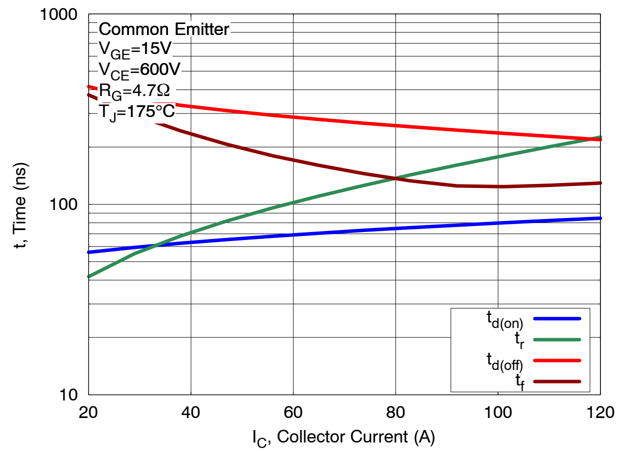


Figure 14. Switching Time vs Collector Current

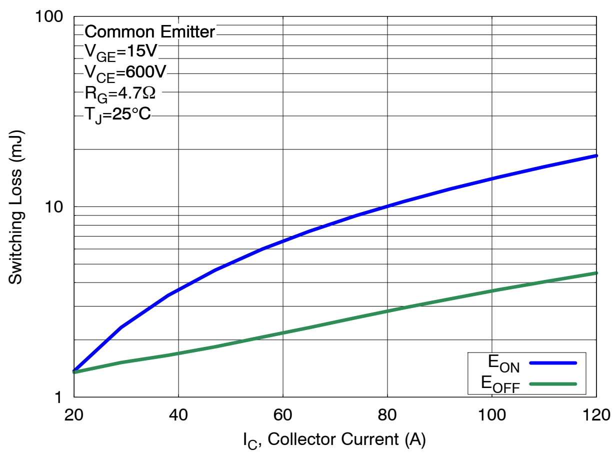


Figure 15. Switching Loss vs Gate Resistance

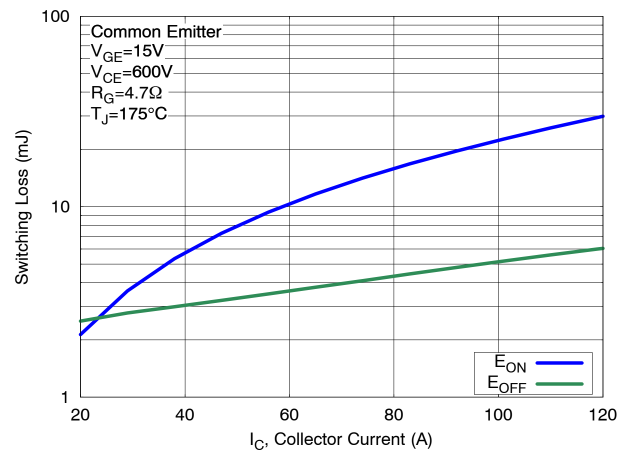


Figure 16. Switching Loss vs Collector Current

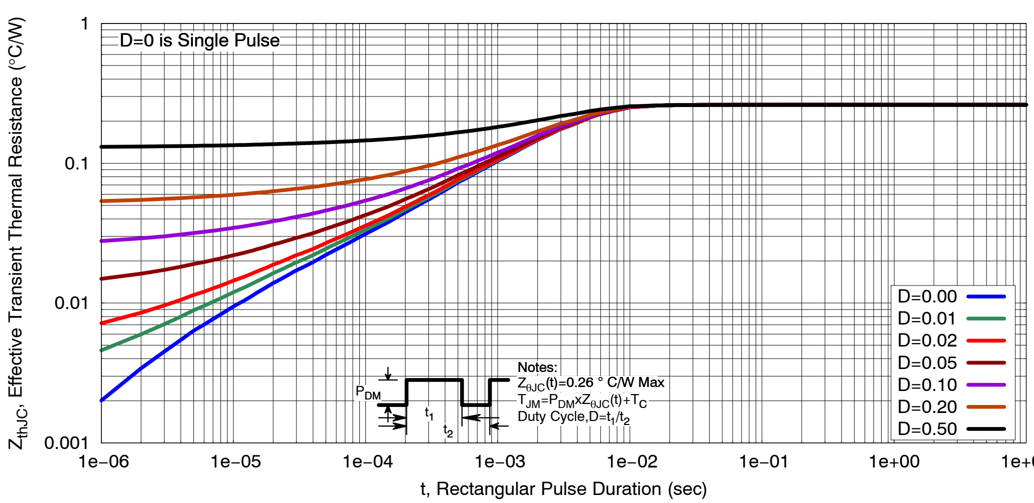
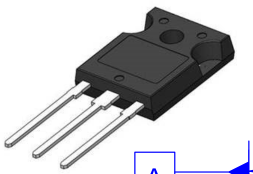
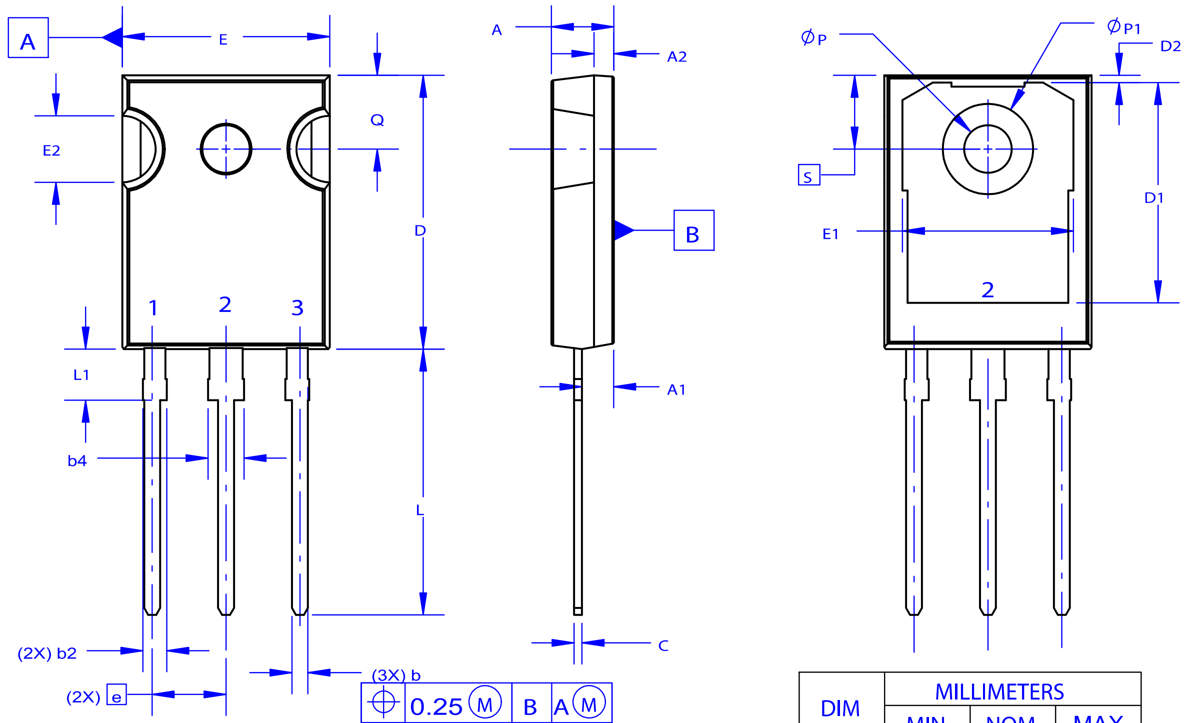


Figure 17. Transient Thermal Impedance of IGBT



TO−247−3LD
CASE 340CX
ISSUE A

DATE 06 JUL 2020

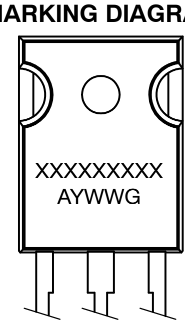


NOTES: UNLESS OTHERWISE SPECIFIED.

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.

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
ØP	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	~	~
ØP1	6.60	6.80	7.00

GENERIC MARKING DIAGRAM*



XXXXX = Specific Device Code
A = Assembly Location
Y = 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.

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