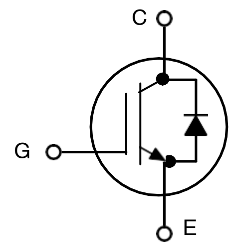
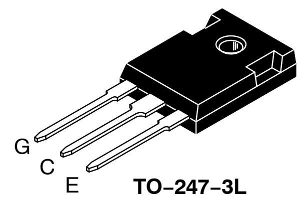
Field Stop Trench IGBT

40 A, 650 V

AFGHL40T65SPD

V_{CES}	E_{on}	$V_{CE(Sat)}$
650 V	1.16 mJ	1.85 V





TO−247−3L
CASE 340CX

Description

Using the novel field stop 3rd generation IGBT technology, AFGHL40T65SPD offers the optimum performance with both low conduction loss and switching loss for a high efficiency operation in various applications, which provides 50 V higher blocking voltage and rugged high current switching reliability.

Meanwhile, this part also offers and advantage of outstanding performance in parallel operation.

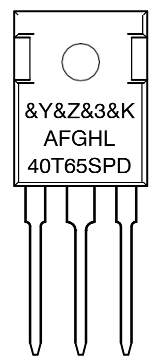
Features

- AEC−Q101 Qualified
- Low Saturation Voltage: $V_{CE(Sat)}$ = 1.85 V (Typ.) @ I_C = 40 A
- 100% Of The Part Are Dynamically Tested (Note 1)
- Short Circuit Ruggedness > 5 μS @ 25°C
- Maximum Junction Temperature: T_J = 175°C
- Fast Switching
- Tight Parameter Distribution
- Positive Temperature Co−efficient for Easy Parallel Operating
- Co−Packed With Soft And Fast Recovery Diode

Typical Applications

- On−board Charger
- Air Conditioner Compressor
- PTC Heater
- Motor Drivers
- Other Automotive Power−Train Applications

MARKING DIAGRAM



$Y	= **onsemi** Logo
&Z	= Assembly Plant Code
&3	= 3−Digit Data code
&K	= 2−Digit Lot Traceability code
AFGHL40T65SPD	= Specific Device Code

ORDERING INFORMATION

Device	Package	Shipping
AFGHL40T65SPD	TO−247−3L	30 Units / Rail

ABSOLUTE MAXIMUM RATINGS (T_C = 25°C, Unless otherwise noted)

Symbol	Description	Ratings	Units
V_{CES}	Collector to Emitter Voltage	650	V
V_{GES}	Gate to Emitter Voltage	±20	V
	Transient Gate to Emitter Voltage	±30	V
I_C	Collector Current @ T_C = 25°C	80	A
	Collector Current @ T_C = 100°C	40	
I_{CM}	Pulsed Collector Current (Note 2)	120	A
I_F	Diode Forward Current @ T_C = 25°C	40	A
	Diode Forward Current @ T_C = 100°C	20	
I_{FM}	Pulsed Diode Maximum Forward Current (Note 2)	120	A
P_D	Maximum Power Dissipation @ T_C = 25°C	267	W
	Maximum Power Dissipation @ T_C = 100°C	134	
SCWT	Short Circuit Withstand Time @ T_C = 25°C	5	μs
T_J	Operating Junction Temperature	–55 to +175	°C
T_{stg}	Storage Temperature Range	–55 to +175	°C
T_L	Maximum Lead Temp. For soldering Purposes, ⅛” from case for 5 seconds	300	°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. V_{CC} = 400 V, V_{GE} = 15 V, I_C = 120 A, R_G = 20 Ω, Inductive Load.
2. Repetitive rating: pulse width limited by max. Junction temperature.

THERMAL CHARACTERISTICS

Symbol	Rating	Max.	Units
$R_{\theta JC}$	Thermal Resistance Junction to Case, for IGBT	0.43	°C/W
$R_{\theta JC}$	Thermal Resistance Junction to Case, for Diode	1.69	°C/W
$R_{\theta JA}$	Thermal Resistance Junction to Ambient	40	°C/W

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
OFF CHARACTERISTICS						
Collector−emitter Breakdown Voltage, Gate−emitter Short−circuited	V_{GE} = 0 V, I_C = 1mA	BV_{CES}	650	–	–	V
Temperature Coefficient of Breakdown Voltage	V_{GE} = 0 V, I_C = 1mA		–	0.6	–	V/°C
Collector−emitter Cut−off Current, Gate−emitter Short−circuited	V_{GE} = 0 V, V_{CE} = 650 V V_{GE} = 0 V, V_{CE} = 650 V, T_J = 175°C	I_{CES}	– –	– 750	250 –	μA
Gate Leakage Current, Collector−emitter Short−circuited	V_{GE} = 20 V, V_{CE} = 0 V	I_{GES}	–	–	±400	nA
ON CHARACTERISTICS						
Gate−emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 40 mA	$V_{GE(th)}$	4.0	5.0	7.5	V
Collector−emitter Saturation Voltage	V_{GE} = 15 V, I_C = 40 A V_{GE} = 15 V, I_C = 40 A, T_J = 175°C	$V_{CE(sat)}$	1.4 –	1.85 2.51	2.4 –	V
DYNAMIC CHARACTERISTICS						
Input Capacitance	V_{CE} = 30 V, V_{GE} = 0 V, f = 1 MHz	Cies	–	1518	–	pF
Output Capacitance		Coes	–	91	–	
Reverse Transfer Capacitance		Cres	–	15	–	
Gate Charge Total	V_{CE} = 400 V, I_C = 40 V, V_{GE} = 15 V	Q_g	–	36	–	nC
Gate to Emitter Charge		Qge	–	11	–	
Gate to Collector Charge		Qgc	–	12	–	
SWITCHING CHARACTERISTICS						
Turn−on Delay Time	T_C = 25°C V_{CC} = 400 V, I_C = 40 A Rg = 6 Ω V_{GE} = 15 V Inductive Load, T_C = 25°C	td(on)	–	18	–	ns
Rise Time		t_r	–	42	–	
Turn−off Delay Time		td(off)	–	35	–	
Fall Time		t_f	–	10	–	
Turn−on Switching Loss		Eon	–	1.16	–	mJ
Turn−off Switching Loss		Eoff	–	0.27	–	
Total Switching Loss		Ets	–	1.43	–	
Turn−on Delay Time	T_C = 175°C V_{CC} = 400 V, I_C = 40 A Rg = 6 Ω V_{GE} = 15 V Inductive Load	td(on)	–	16	–	ns
Rise Time		t_r	–	40	–	
Turn−off Delay Time		td(off)	–	37	–	
Fall Time		t_f	–	11	–	
Turn−on Switching Loss		Eon	–	1.59	–	mJ
Turn−off Switching Loss		Eoff	–	0.42	–	
Total Switching Loss		Ets	–	2.01	–	
DIODE CHARACTERISTICS						
Forward Voltage	I_F = 20 A I_F = 20 A, T_J = 175°C	V_F	1.4 –	2.2 1.9	2.7 –	V
Reverse Recovery Time	T_J = 25°C I_F = 20 A, di_F/dt = 200 A/μs	trr	–	35	–	ns
Reverse Recovery Charge		Qrr	–	58	–	μC
Reverse Recovery Time	T_J = 175°C I_F = 20 A, di_F/dt = 200 A/μs	trr	–	214	–	ns
Reverse Recovery Charge		Qrr	–	776	–	μC
Reverse Recovery Energy		Erec	–	51	–	μJ

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 PERFORMANCE CHARACTERISTICS

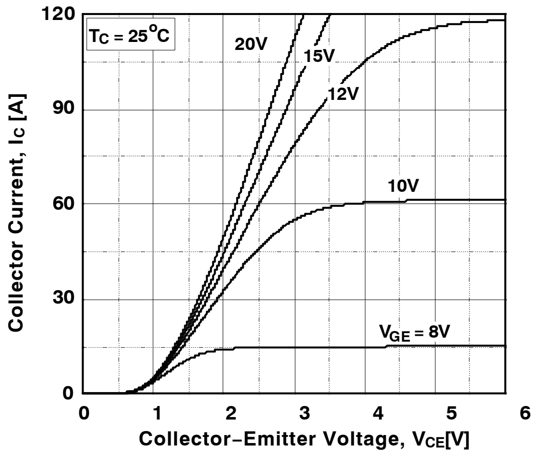


Figure 1. Typical Output Characteristics

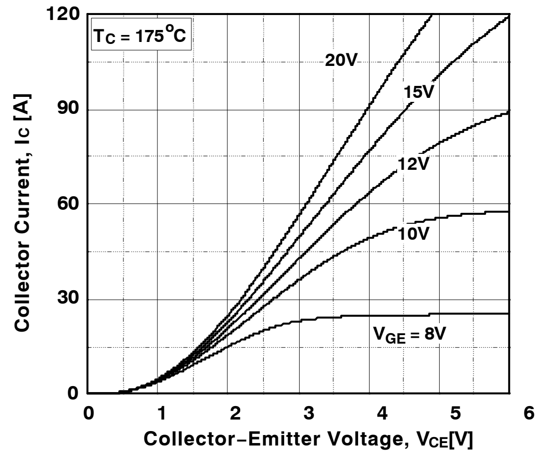


Figure 2. Typical Output Characteristics

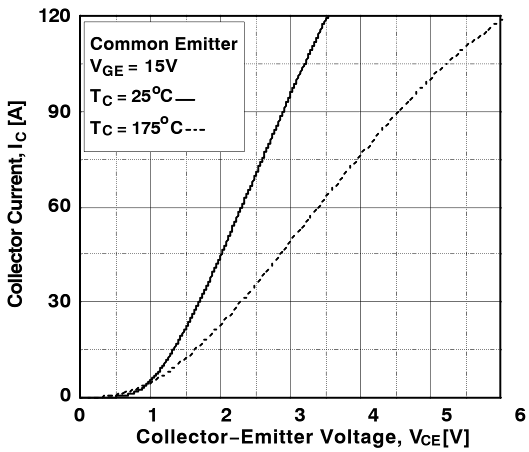


Figure 3. Typical Saturation Voltage Characteristics

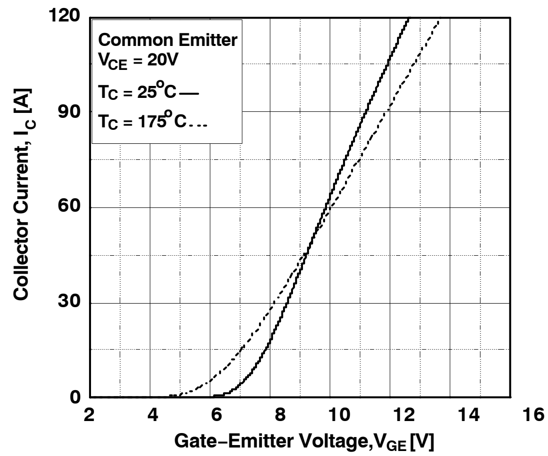


Figure 4. Transfer Characteristics

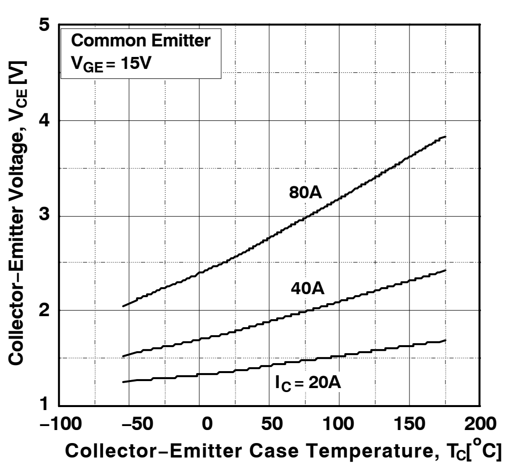


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

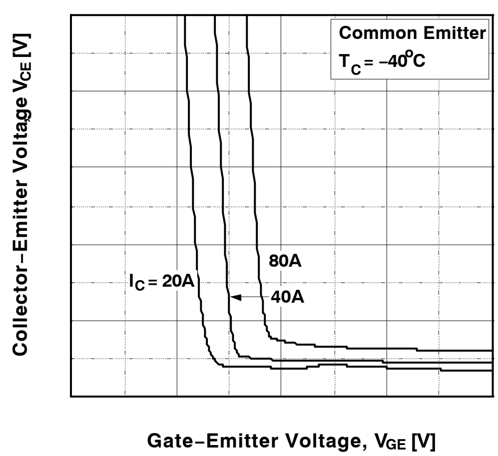


Figure 6. Saturation Voltage vs. V_{GE}

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

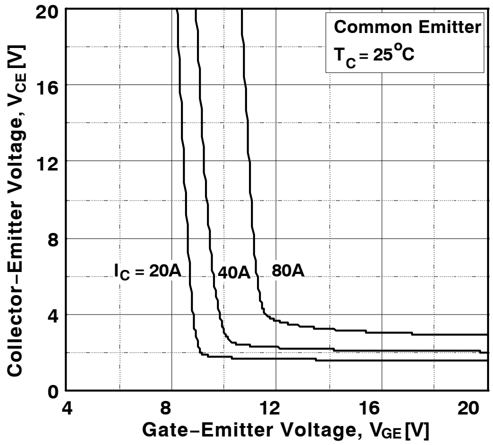


Figure 7. Saturation Voltage vs. V_{GE}

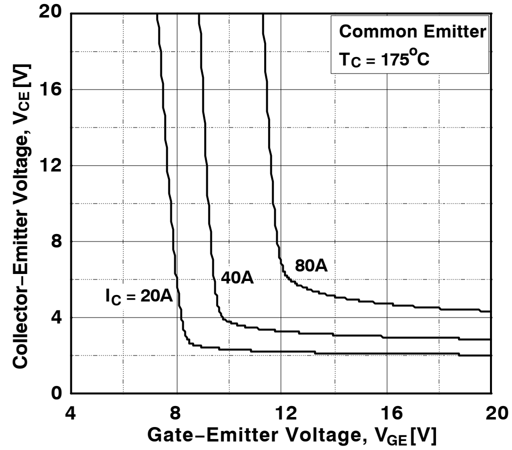


Figure 8. Saturation Voltage vs. V_{GE}

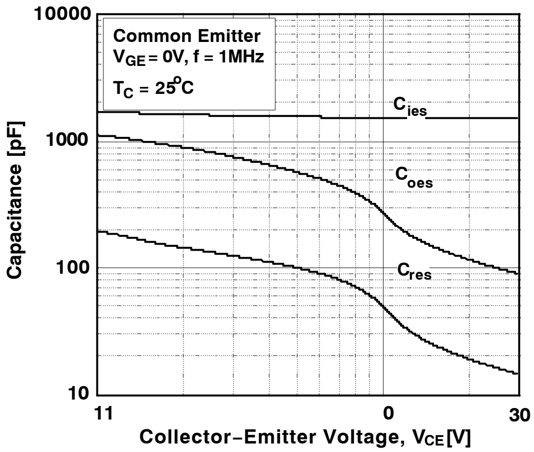


Figure 9. Capacitance Characteristics

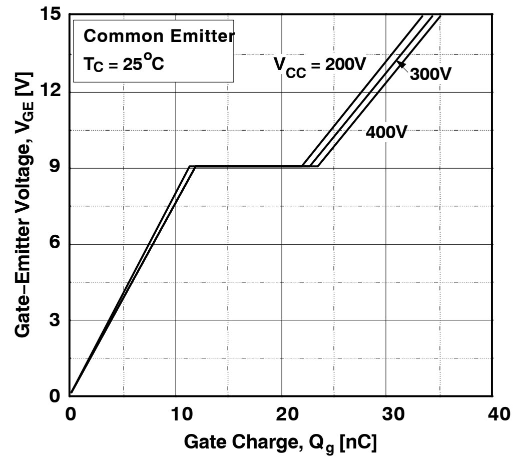


Figure 10. Gate charge Characteristics

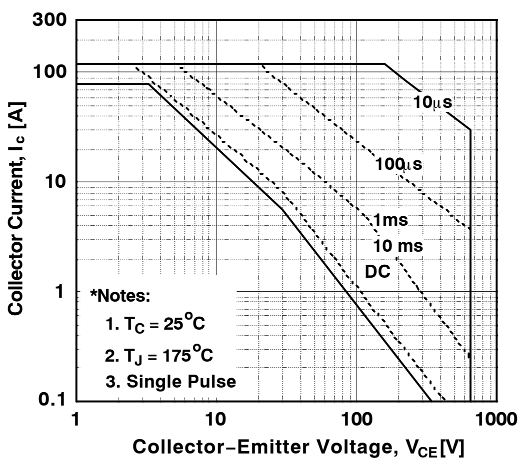


Figure 11. SOA Characteristics

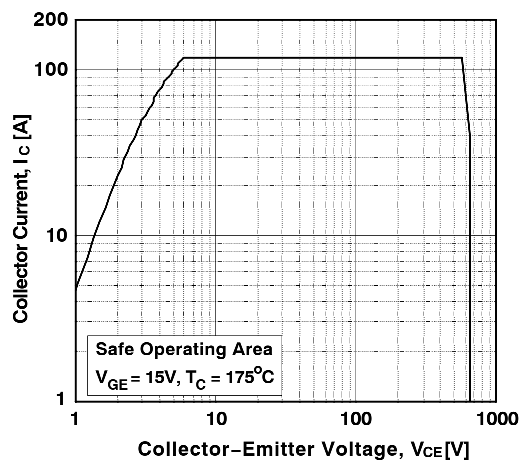


Figure 12. Turn off Switching SOA Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

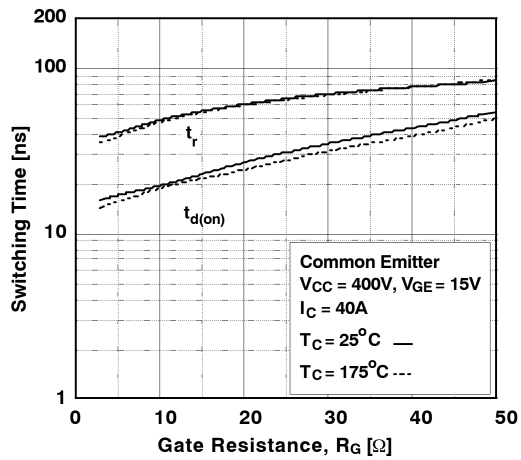


Figure 13. Turn−on Characteristics vs. Gate Resistance

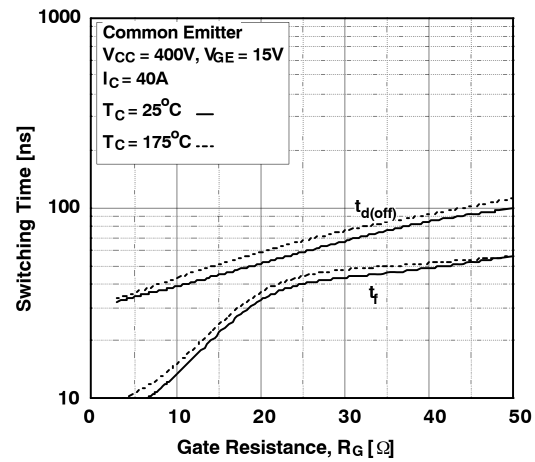


Figure 14. Turn−off Characteristics vs. Gate Resistance

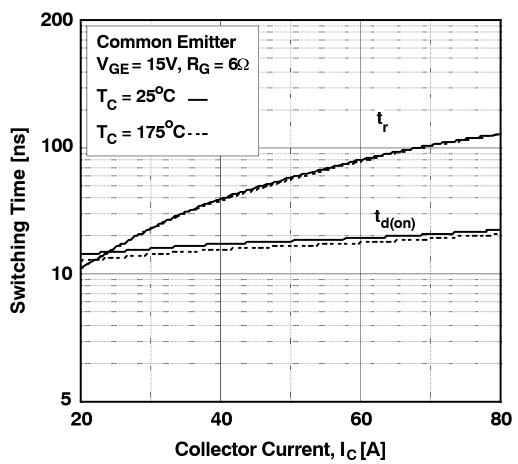


Figure 15. Turn−on Characteristics vs. Collector Current

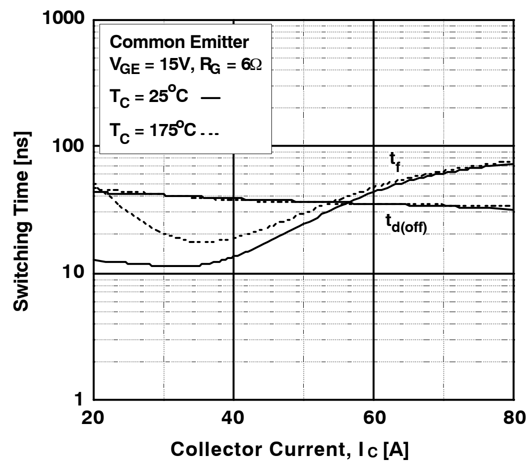


Figure 16. Turn−off Characteristics vs. Collector Current

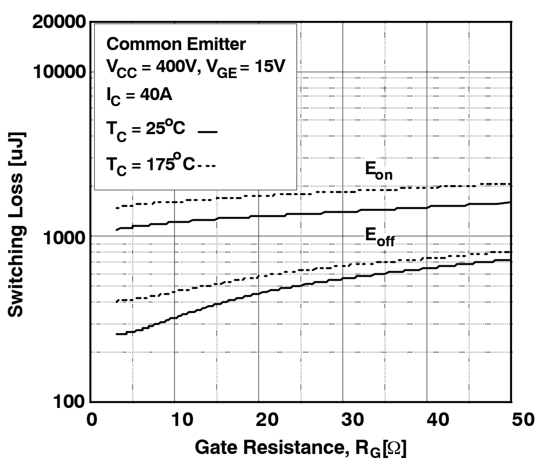


Figure 17. Switching Loss vs Gate Resistance

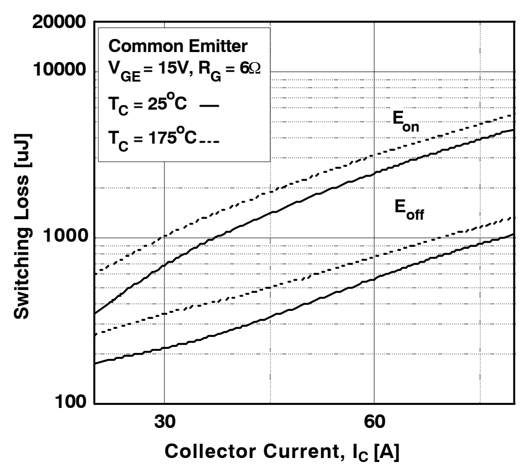


Figure 18. Switching Loss vs Collector Current

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

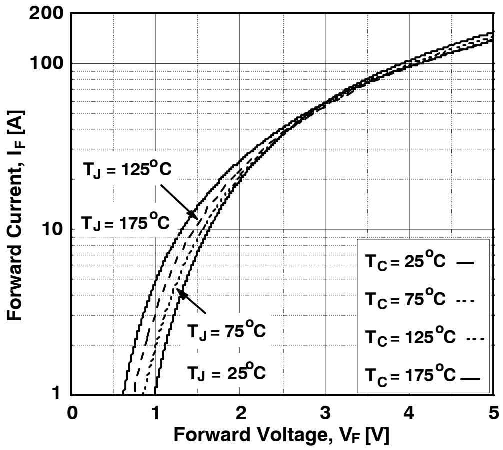


Figure 19. Forward Characteristics

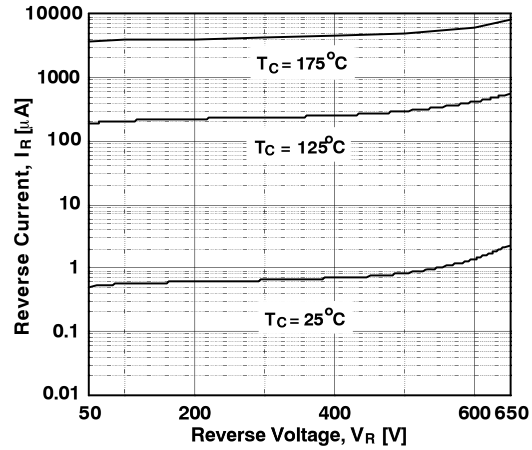


Figure 20. Reverse Current

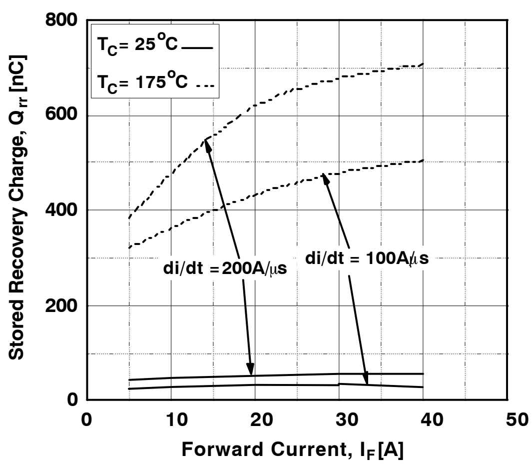


Figure 21. Stored Charge

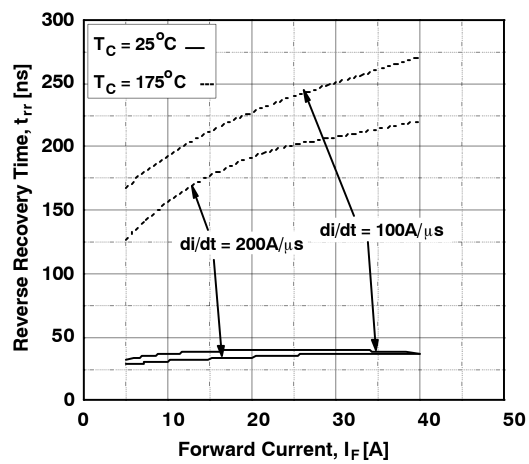


Figure 22. Reverse Recovery Time

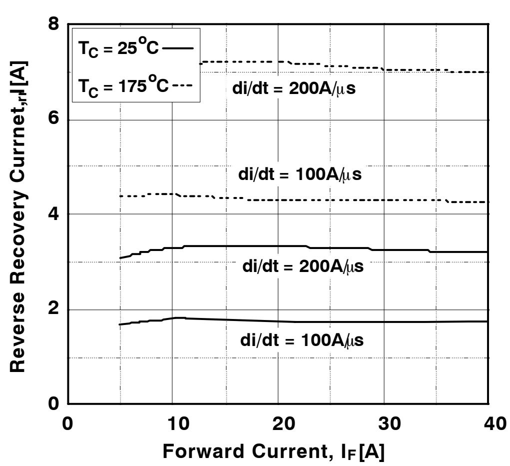


Figure 23. Reverse Recovery Current

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

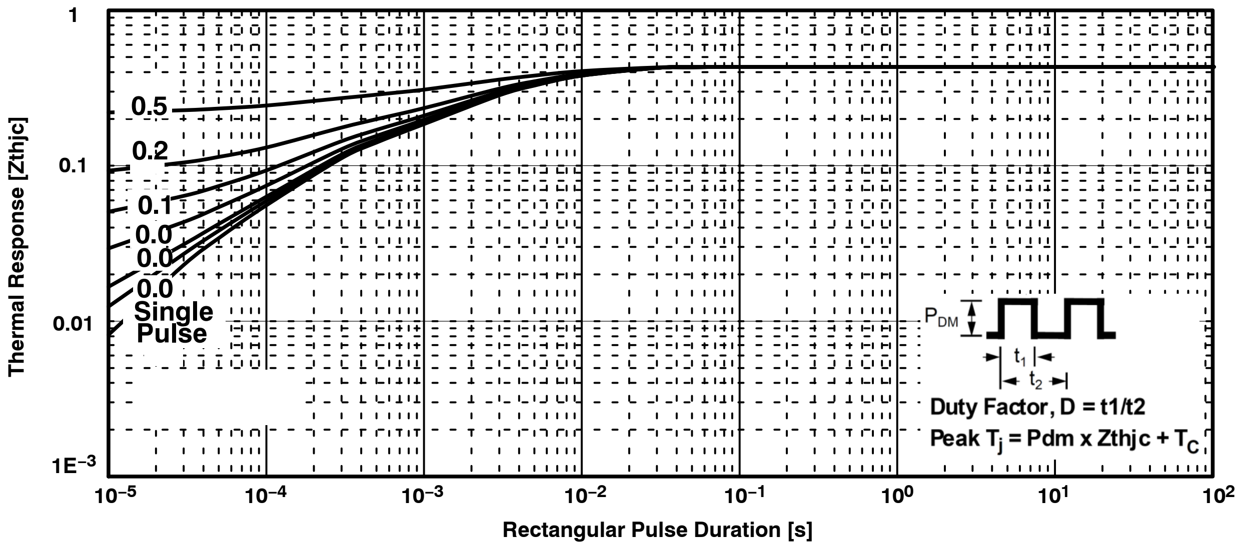


Figure 24. Transient Thermal Impedance of IGBT

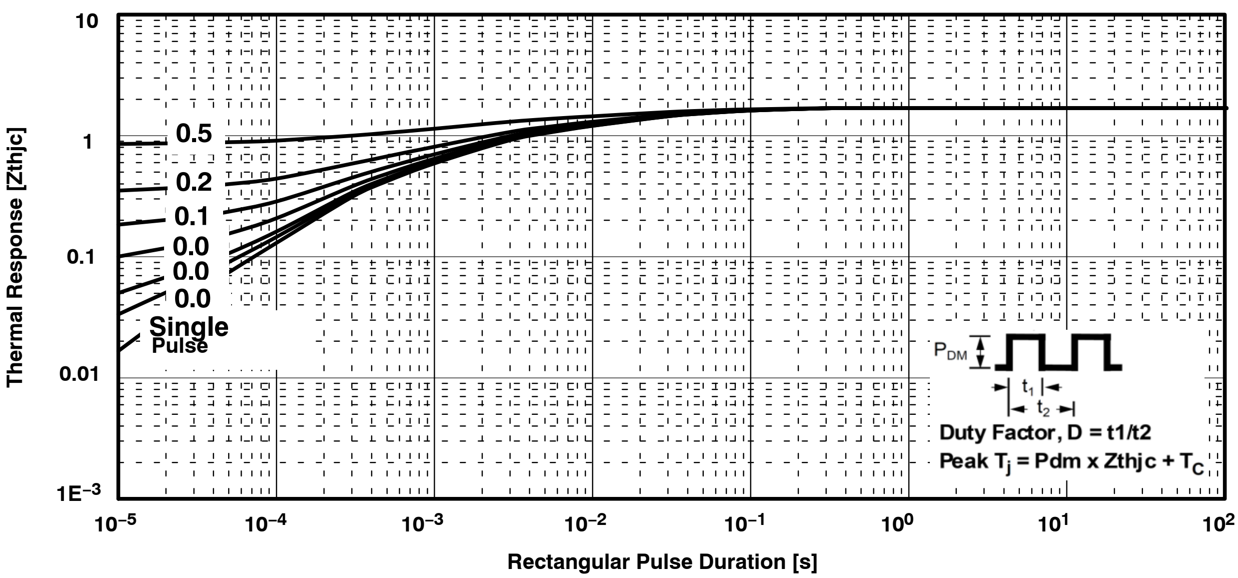
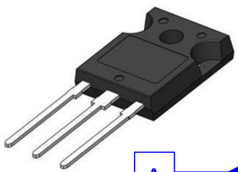
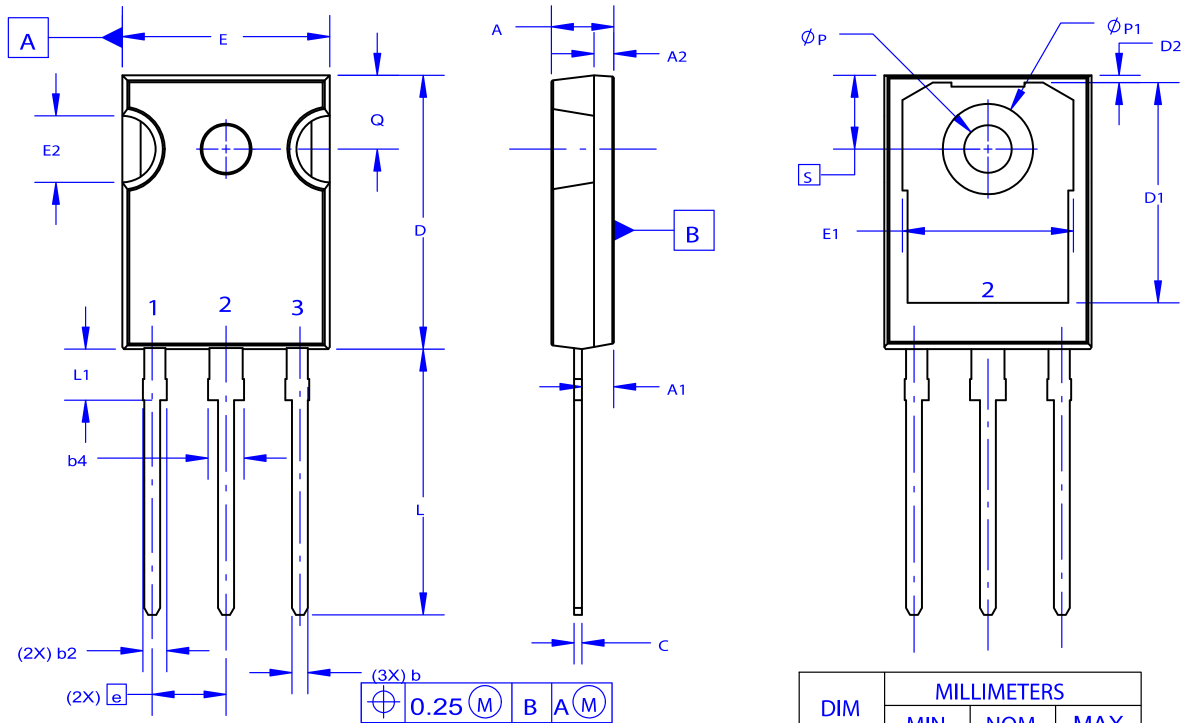


Figure 25. Transient Thermal Impedance of Diode

TO−247−3LD
CASE 340CX
ISSUE A

DATE 06 JUL 2020



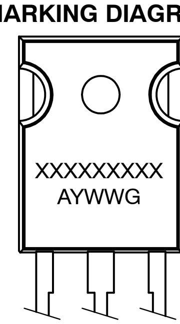


NOTES: UNLESS OTHERWISE SPECIFIED.

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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DESCRIPTION:	**TO−247−3LD**		**PAGE 1 OF 1**

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