IGBT - Field Stop, Trench

1000 V, 40 A

FGH40T100SMD, FGH40T100SMD-F155

Description

Using innovative field stop trench IGBT technology, ON Semiconductor's new series of field stop trench IGBTs offer the optimum performance for hard switching application such as solar inverter, UPS, welder and PFC applications.

Features

- High Current Capability
- Low Saturation Voltage: $V_{CE(sat)}$ = 1.9 V(Typ.) @ I_C = 40 A
- High Input Impedance
- Fast Switching
- These Devices are Pb−Free and are RoHS Compliant

Applications

- UPS, Welder, PFC

ON Semiconductor®

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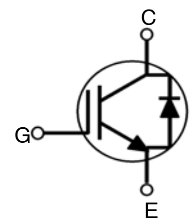
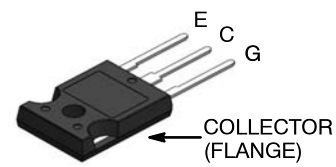
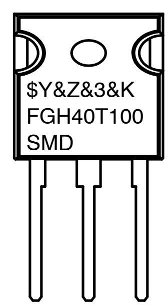




TO−247−3LD CASE 340CK FGH40T100SMD	TO−247−3LD CASE 340CH FGH40T100SMD−F155

MARKING DIAGRAM



$Y	= ON Semiconductor Logo
&Z	= Assembly Plant Code
&3	= Numeric Date Code
&K	= Lot Code
FGH40T100SMD	= Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

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

Description		Symbol	Ratings	Unit
Collector to Emitter Voltage		V_{CES}	1000	V
Gate to Emitter Voltage		V_{GES}	±25	V
Transient Gate to Emitter Voltage			±30	V
Collector Current	T_C = 25°C	I_C	80	A
Collector Current	T_C = 100°C		40	A
Pulsed Collector Current (Note 1)	T_C = 25°C	I_{CM}	120	A
Diode Forward Current	T_C = 25°C	I_F	80	A
Diode Forward Current	T_C = 100°C		40	A
Pulsed Diode Forward Current (Note 1)	T_C = 25°C	I_{FM}	120	A
Maximum Power Dissipation	T_C = 25°C	P_D	333	W
Maximum Power Dissipation	T_C = 100°C		166	W
Operating Junction Temperature		T_J	−55 to +175	°C
Storage Temperature Range		T_{stg}	−55 to +175	°C
Maximum Lead Temp. for Soldering Purposes, 1/8” from Case for 5 Seconds		T_L	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. Repetitive Rating: Pulse width limited by max. junction temperature.

THERMAL CHARACTERISTICS

Parameter	Symbol	Typ	Max	Unit
Thermal Resistance, Junction to Case (IGBT)	$R_{\theta JC}$	–	0.45	°C/W
Thermal Resistance, Junction to Case (Diode)	$R_{\theta JC}$	–	0.8	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	–	40	°C/W

PACKAGE MARKING AND ORDERING INFORMATION

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGH40T100SMD	FGH40T100SMD	TO−247−3	–	–	30
FGH40T100SMD	FGH40T100SMD−F155	TO−247−3	–	–	30

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector to Emitter Breakdown Voltage	BV_{CES}	V_{GE} = 0 V, I_C = 1 mA	1000	–	–	V
Temperature Coefficient of Breakdown Voltage	$\Delta BV_{CES}/\Delta T_J$	V_{GE} = 0 V, I_C = 250 μA		0.6		V/°C
Collector Cut−Off Current	I_{CES}	$V_{CE} = V_{CES}$, V_{GE} = 0 V	–	–	1000	μA
G−E Leakage Current	I_{GES}	$V_{GE} = V_{GES}$, V_{CE} = 0 V	–	–	±500	nA
ON CHARACTERISTICS						
G−E Threshold Voltage	$V_{GE(th)}$	I_C = 250 μA, $V_{CE} = V_{GE}$	4.2	5.3	6.5	V
Collector to Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 40 A, V_{GE} = 15 V	–	1.9	2.3	V
		I_C = 40 A, V_{GE} = 15 V, T_C = 175°C	–	2.4	–	V

ELECTRICAL CHARACTERISTICS OF THE IGBT (T_C = 25°C unless otherwise noted) (continued)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ies}	V_{CE} = 30 V, V_{GE} = 0 V, f = 1 MHz	–	3980	5295	pF
Output Capacitance	C_{oes}		–	124	165	pF
Reverse Transfer Capacitance	C_{res}		–	76	115	pF
SWITCHING CHARACTERISTICS						
Turn−On Delay Time	$t_{d(on)}$	V_{CC} = 600 V, I_C = 40 A, R_G = 10 Ω, V_{GE} = 15 V, Inductive Load, T_C = 25°C	–	29	38	ns
Rise Time	t_r		–	42	55	ns
Turn−Off Delay Time	$t_{d(off)}$		–	285	371	ns
Fall Time	t_f		–	23	30	ns
Turn−On Switching Loss	E_{on}		–	2.35	3.1	mJ
Turn−Off Switching Loss	E_{off}		–	1.15	1.5	mJ
Total Switching Loss	E_{ts}		–	3.5	4.6	mJ
Turn−On Delay Time	$t_{d(on)}$	V_{CC} = 600 V, I_C = 40 A, R_G = 10 Ω, V_{GE} = 15 V, Inductive Load, T_C = 175°C	–	27	36	ns
Rise Time	t_r		–	49	64	ns
Turn−Off Delay Time	$t_{d(off)}$		–	285	371	ns
Fall Time	t_f		–	20	26	ns
Turn−On Switching Loss	E_{on}		–	4.4	5.7	mJ
Turn−Off Switching Loss	E_{off}		–	1.9	2.5	mJ
Total Switching Loss	E_{ts}		–	6.3	8.2	mJ
Total Gate Charge	Q_g	V_{CE} = 600 V, I_C = 40 A, V_{GE} = 15 V	–	265	398	nC
Gate to Emitter Charge	Q_{ge}		–	32	48	nC
Gate to Collector Charge	Q_{gc}		–	135	203	nC

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

Parametr	Symbol	Test Conditions		Min	Typ	Max	Unit
Diode Forward Voltage	V_{FM}	I_F = 40 A	T_C = 25°C	–	3.4	4.4	V
			T_C = 175°C	–	2.6	–	
Diode Reverse Recovery Time	t_{rr}	I_F = 40 A, dI_F/dt = 200 A/µs	T_C = 25°C	–	60	78	ns
			T_C = 175°C	–	256	–	
Diode Reverse Recovery Charge	Q_{rr}		T_C = 25°C	–	185	260	nC
			T_C = 175°C	–	1512	–	

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

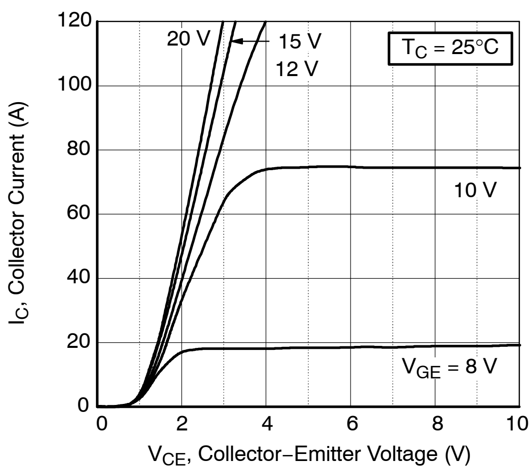


Figure 1. Typical Output Characteristics

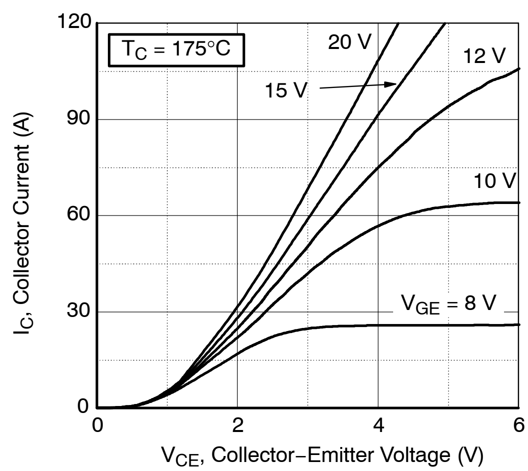


Figure 2. Typical Output Characteristics

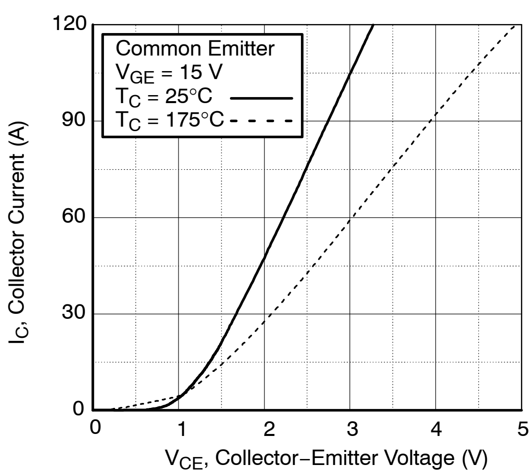


Figure 3. Typical Saturation Voltage Characteristics

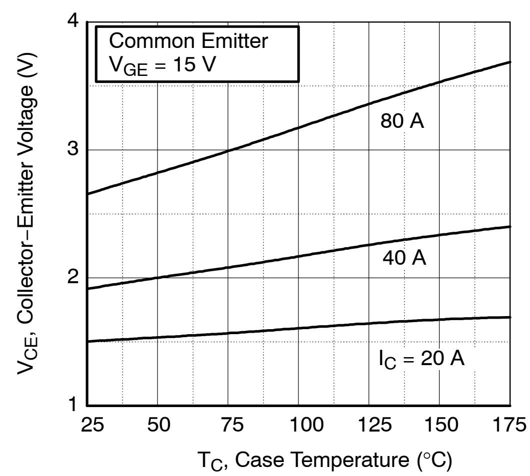


Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level

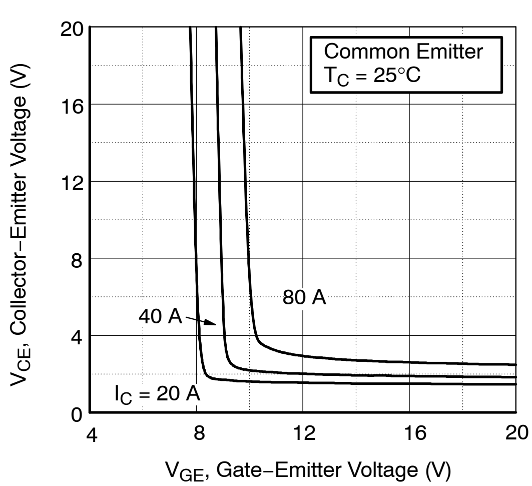


Figure 5. Saturation Voltage vs V_{GE}

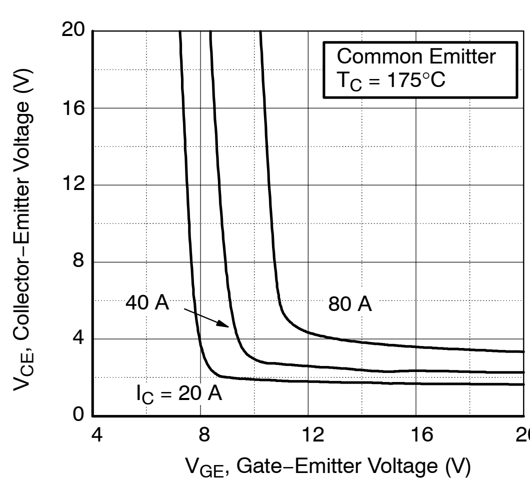


Figure 6. Saturation Voltage vs V_{GE}

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

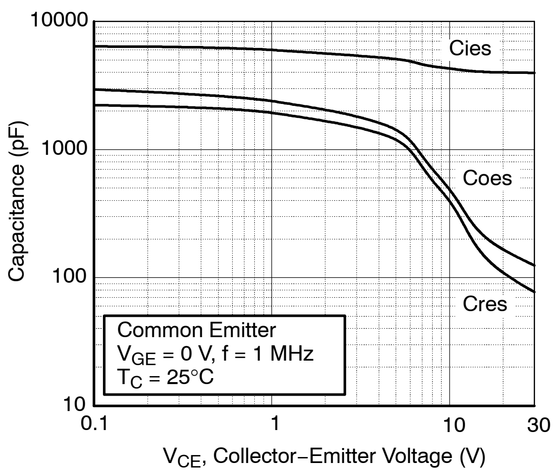


Figure 7. Capacitance Characteristics

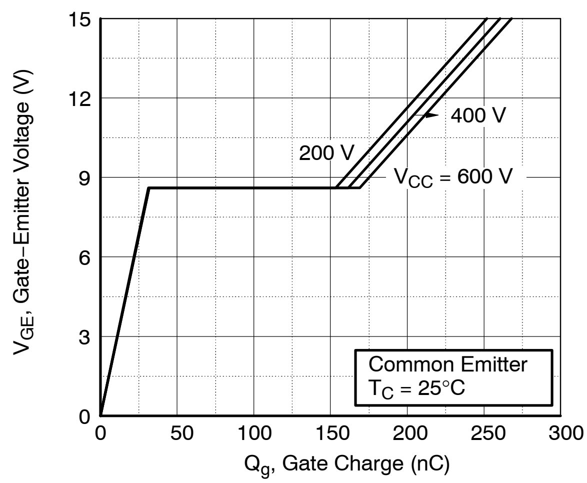


Figure 8. Gate Charge Characteristics

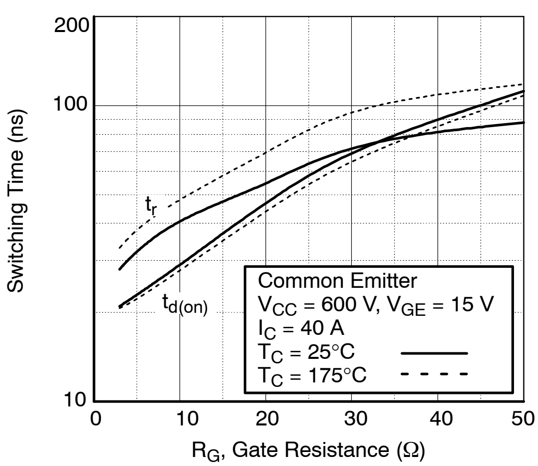


Figure 9. Turn−On Characteristics vs. Gate Resistance

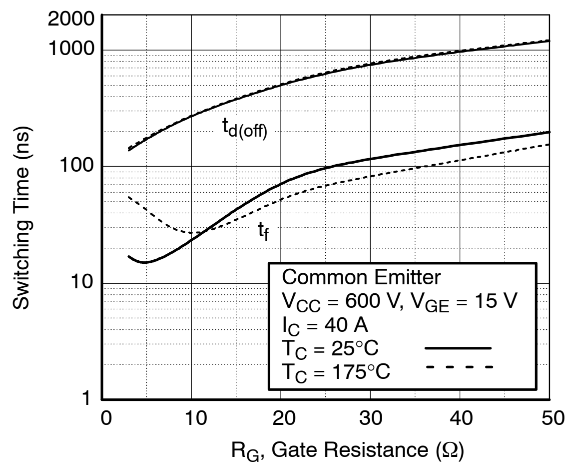


Figure 10. Turn−Off Characteristics vs. Gate Resistance

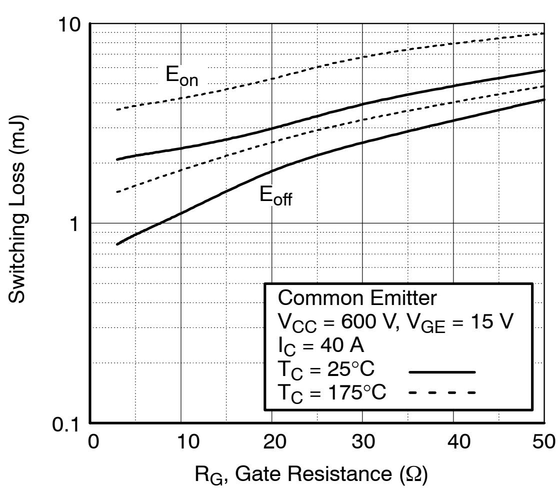


Figure 11. Switching Loss vs. Gate Resistance

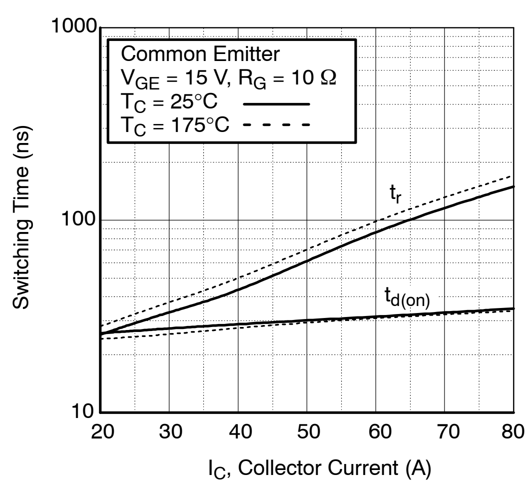


Figure 12. Turn−On Characteristics vs. Collector Current

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

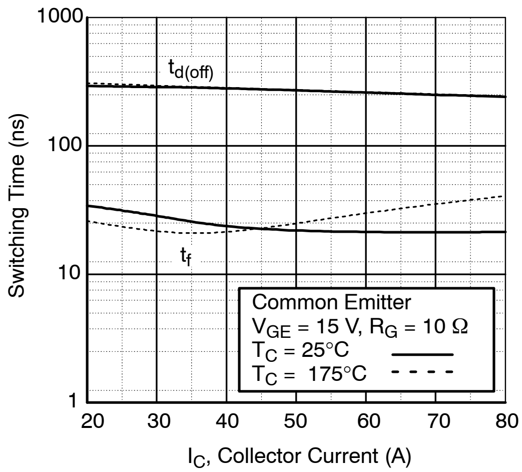


Figure 13. Turn−Off Characteristics vs. Collector Current

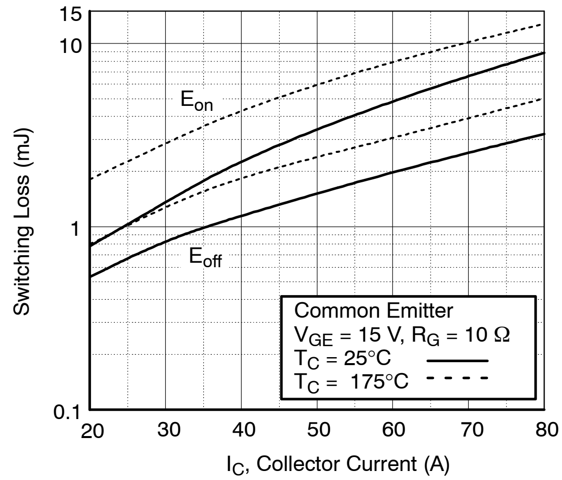


Figure 14. Switching Loss vs. Collector Current

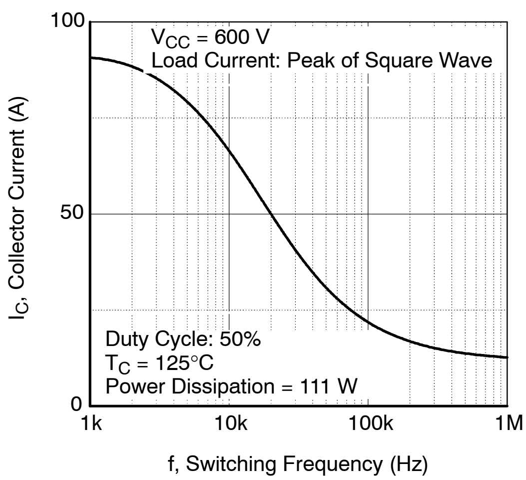


Figure 15. Load Current vs. Frequency

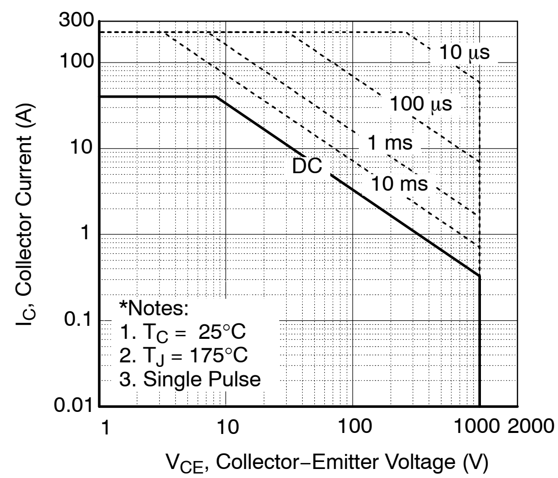


Figure 16. SOA Characteristics

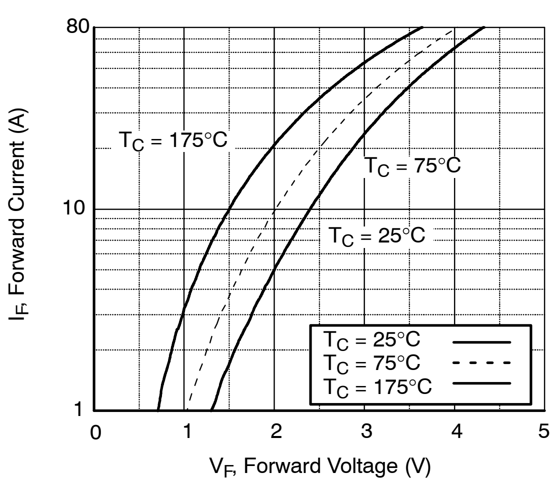


Figure 17. Forward Characteristics

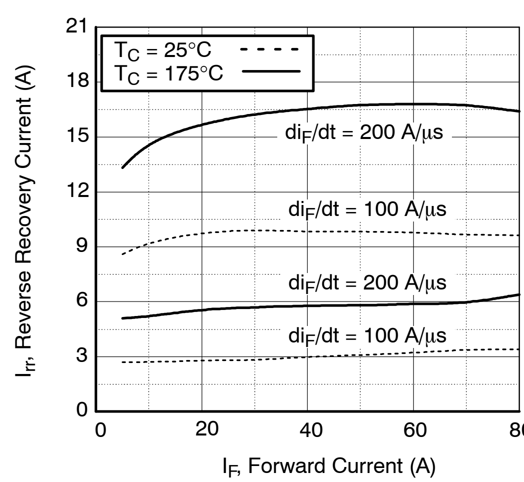


Figure 18. Reverse Recovery Current

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

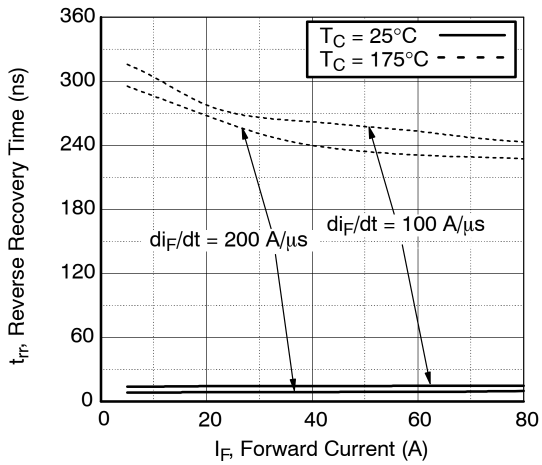


Figure 19. Reverse Recovery Time

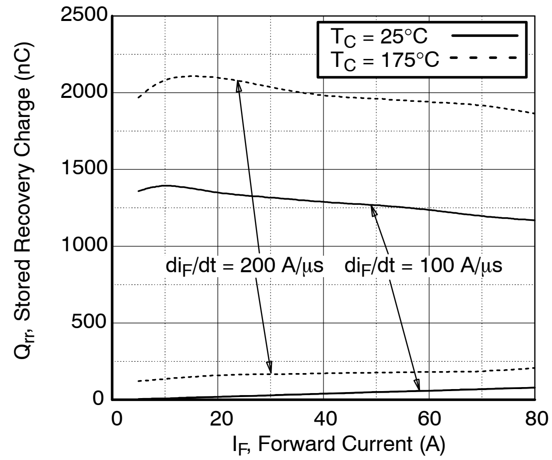


Figure 20. Stored Charge

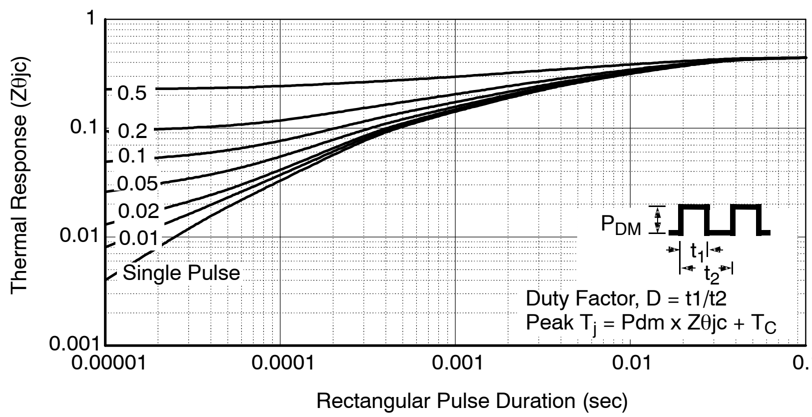


Figure 21. Transient Thermal Impedance of IGBT

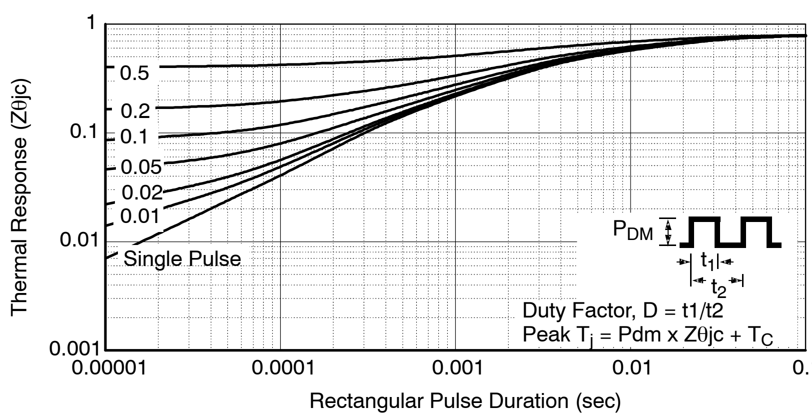


Figure 22. Transient Thermal Impedance of Diode

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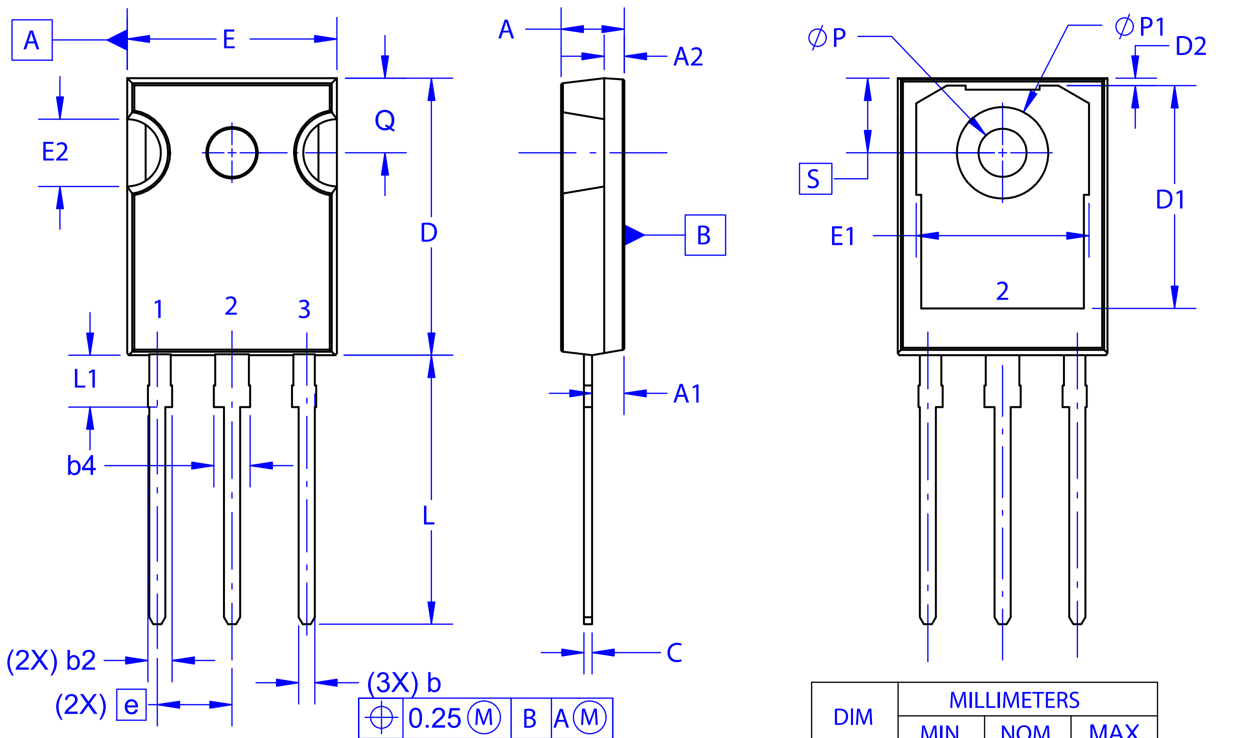
TO−247−3LD
CASE 340CH
ISSUE A

DATE 09 OCT 2019

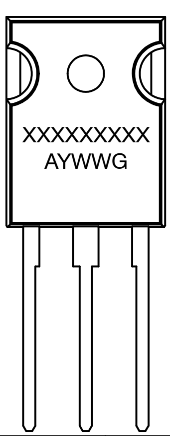


DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.58	4.70	4.82
A1	2.29	2.475	2.66
A2	1.40	1.50	1.60
D	20.32	20.57	20.82
E	15.37	15.62	15.87
E2	4.96	5.08	5.20
e	~	5.56	~
L	19.75	20.00	20.25
L1	3.69	3.81	3.93
ØP	3.51	3.58	3.65
Q	5.34	5.46	5.58
S	5.34	5.46	5.58
b	1.17	1.26	1.35
b2	1.53	1.65	1.77
b4	2.42	2.54	2.66
c	0.51	0.61	0.71
D1	13.08	~	~
D2	0.51	0.93	1.35
E1	12.81	~	~
ØP1	6.61	6.73	6.85

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*



XXXX = 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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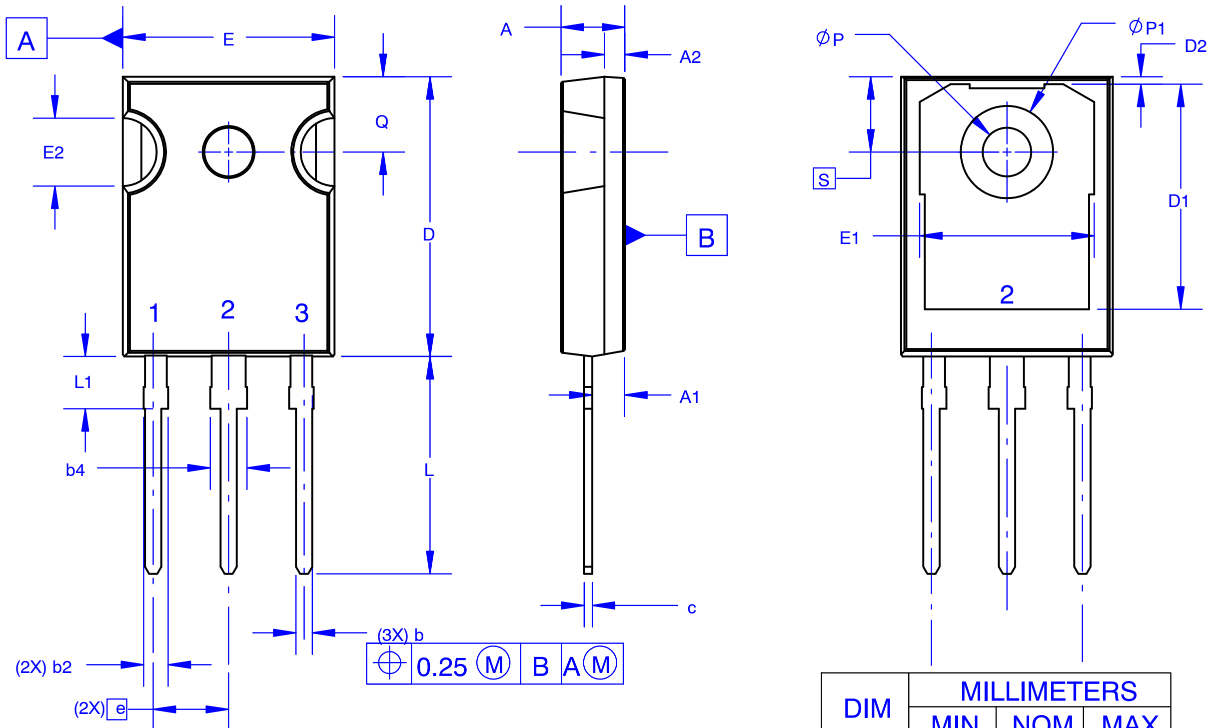
TO−247−3LD SHORT LEAD
CASE 340CK
ISSUE A

DATE 31 JAN 2019



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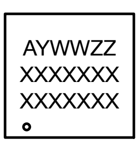
DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.58	4.70	4.82
A1	2.20	2.40	2.60
A2	1.40	1.50	1.60
b	1.17	1.26	1.35
b2	1.53	1.65	1.77
b4	2.42	2.54	2.66
c	0.51	0.61	0.71
D	20.32	20.57	20.82
D1	13.08	~	~
D2	0.51	0.93	1.35
E	15.37	15.62	15.87
E1	12.81	~	~
E2	4.96	5.08	5.20
e	~	5.56	~
L	15.75	16.00	16.25
L1	3.69	3.81	3.93
ØP	3.51	3.58	3.65
ØP1	6.60	6.80	7.00
Q	5.34	5.46	5.58
S	5.34	5.46	5.58

GENERIC
MARKING DIAGRAM*



XXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
ZZ = Assembly Lot Code

*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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