ON Semiconductor

Is Now

To learn more about onsemi™, please visit our website at www.onsemi.com

FGHL40S65UQ

Product Preview

Field Stop Trench IGBT

40 A, 650 V

Using the novel field stop generation IGBT technology, ON Semiconductor's new series of field stop 4th generation of RC IGBTs offer superior conduction and switching performance and easy parallel operation. This device is well suited for the resonant or soft switching application such as induction heating and microwave oven.

Features

- Maximum Junction Temperature: T_J = 175°C
- Positive Temperature Co−efficient for Easy Parallel Operating
- High Current Capability
- Low Saturation Voltage: $V_{CE(sat)}$ = 1.36 V (Typ.) @I_C = 40 A
- 100% of the Parts tested for I_{LM} (Note 1)
- High Input Impedance
- Fast Switching
- Tighten Parameter Distribution
- RoHS Compliant
- IGBT with Monolithic Reverse Conducting Diode

Typical Applications

- Induction Heating
- Microwave Oven
- Soft Switching Application

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 @T_C = 25°C @T_C = 100°C	I_C	80 40	A
Pulsed Collector Current (Note 1)	I_{LM}	120	A
Pulsed Collector Current (Note 2)	I_{CM}	120	A
Diode Forward Current @T_C = 25°C @T_C = 100°C	I_F	40 20	A
Pulsed Diode Maximum Forward Current	I_{FM}	120	A
Maximum Power Dissipation @T_C = 25°C @T_C = 100°C	P_D	231 115	W
Operating Junction / Storage Temperature Range	T_J, T_{STG}	−55 to +175	°C
Maximum Lead Temp. for Soldering Purposes, 1/8" from case for 5 seconds	T_L	260	°C

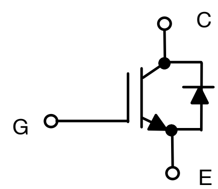
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

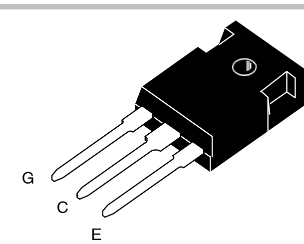
1. V_{CC} = 400 V, V_{GE} = 15 V, I_C = 120 A, R_G = 7 Ω, Inductive Load, 100% Tested.
2. Repetitive rating: pulse width limited by max. Junction temperature.

ON Semiconductor®

www.onsemi.com

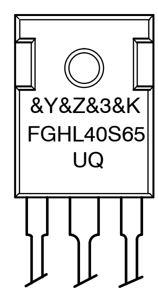
40 A, 650 V
$V_{CE(sat)}$ = 1.36 V (Typ.)





TO−247−3L
CASE 340CX

MARKING DIAGRAM



&Y	=	ON Semiconductor Logo
&Z	=	Assembly Plant Code
&3	=	3−Digit Data Code
&K	=	2−Digit Lot Traceability Code
FGHL40S65UQ	=	Specific Device Code

ORDERING INFORMATION

Device	Package	Shipping
FGHL40S65UQ	TO−247−3L	30 Units / Rail

This document contains information on a product under development. ON Semiconductor reserves the right to change or discontinue this product without notice.

THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal resistance junction−to−case, for IGBT	$R_{\theta JC}$	0.65	°C/W
Thermal resistance junction−to−case, for Diode	$R_{\theta JC}$	1.69	°C/W
Thermal resistance junction−to−ambient	$R_{\theta JA}$	40	°C/W

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTIC						
Collector−emitter breakdown voltage, gate−emitter short−circuited	V_{GE} = 0 V, I_C = 1 mA	BV_{CES}	650	–	–	V
Temperature Coefficient of Breakdown Voltage	V_{GE} = 0 V, I_C = 1 mA	$\Delta BV_{CES}/\Delta T_J$	–	0.5	–	V/°C
Collector−emitter cut−off current, gate−emitter short−circuited	V_{GE} = 0 V, V_{CE} = 650 V	I_{CES}	–	–	250	μA
Gate leakage current, collector−emitter short−circuited	V_{GE} = 20 V, V_{CE} = 0 V	I_{GES}	–	–	±400	nA
ON CHARACTERISTIC						
Gate−emitter threshold voltage	V_{GE} = V_{CE}, I_C = 40 mA	$V_{GE(th)}$	2.5	4.7	6.5	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	$V_{CE(sat)}$	– –	1.36 1.6	1.7 –	V
DYNAMIC CHARACTERISTIC						
Input capacitance	V_{CE} = 30 V, V_{GE} = 0 V, f = 1 MHz	C_{ies}	–	6054	–	pF
Output capacitance		C_{oes}	–	36	–	
Reverse transfer capacitance		C_{res}	–	30	–	
Gate charge total	V_{CE} = 400 V, I_C = 40 A, V_{GE} = 15 V	Q_g	–	306	–	nC
Gate to emitter charge		Q_{ge}	–	30	–	
Gate to collector charge		Q_{gc}	–	99	–	
SWITCHING CHARACTERISTIC, INDUCTIVE LOAD						
Turn−on delay time	T_J = 25°C V_{CC} = 400 V, I_C = 40 A, R_G = 6 Ω V_{GE} = 15 V Inductive Load	$t_{d(on)}$	–	32	–	ns
Rise time		t_r	–	20	–	
Turn−off delay time		$t_{d(off)}$	–	260	–	
Fall time		t_f	–	13	–	
Turn−on switching loss		E_{ON}	–	1760	–	μJ
Turn−off switching loss		E_{OFF}	–	362	–	
Total switching loss		E_{TS}	–	2122	–	
Turn−on delay time	T_J = 175°C V_{CC} = 400 V, I_C = 40 A, R_G = 6 Ω V_{GE} = 15 V Inductive Load	$t_{d(on)}$	–	30	–	ns
Rise time		t_r	–	28	–	
Turn−off delay time		$t_{d(off)}$	–	284	–	
Fall time		t_f	–	56	–	
Turn−on switching loss		E_{ON}	–	2050	–	μJ
Turn−off switching loss		E_{OFF}	–	590	–	
Total switching loss		E_{TS}	–	2640	–	

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
DIODE CHARACTERISTIC						
Forward voltage	I_F = 20 A I_F = 20 A, T_J = 175°C	V_F	– –	1.24 1.24	1.6 –	V
Reverse Recovery Energy	I_F = 20 A, $\Delta I_F/\Delta t$ = 200 A/μs	E_{REC}	–	359	–	μJ
Diode Reverse Recovery Time	I_F = 20 A, $\Delta I_F/\Delta t$ = 200 A/μs I_F = 20 A, $\Delta I_F/\Delta t$ = 200 A/μs, T_J = 175°C	T_{RR}	–	319 430	–	nS
Diode Reverse Recovery Charge	I_F = 20 A, $\Delta I_F/\Delta t$ = 200 A/μs I_F = 20 A, $\Delta I_F/\Delta t$ = 200 A/μs, T_J = 175°C	Q_{RR}	–	1853 3007	–	nC

TYPICAL CHARACTERISTICS

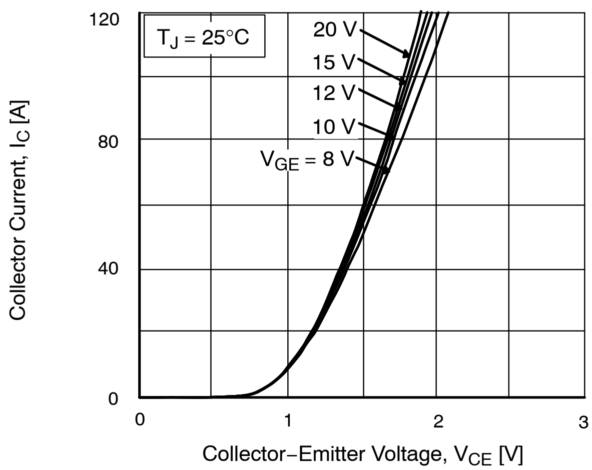


Figure 1. Typical Output Characteristics

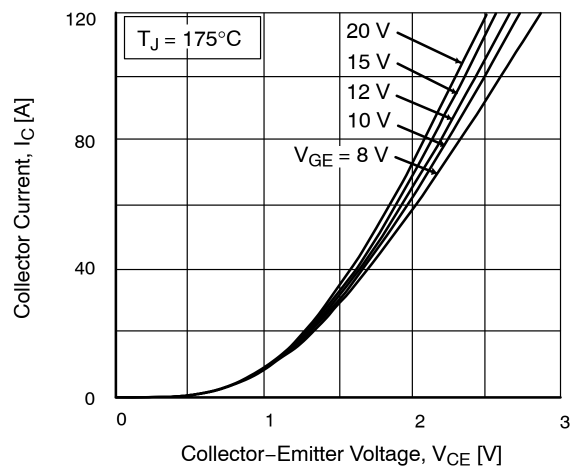


Figure 2. Typical Output Characteristics

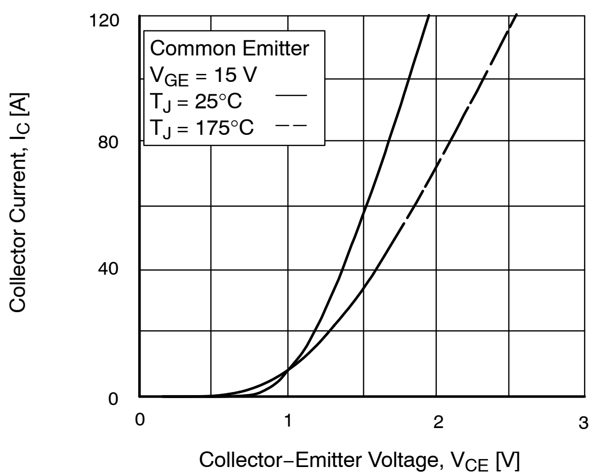


Figure 3. Typical Saturation Voltage Characteristics

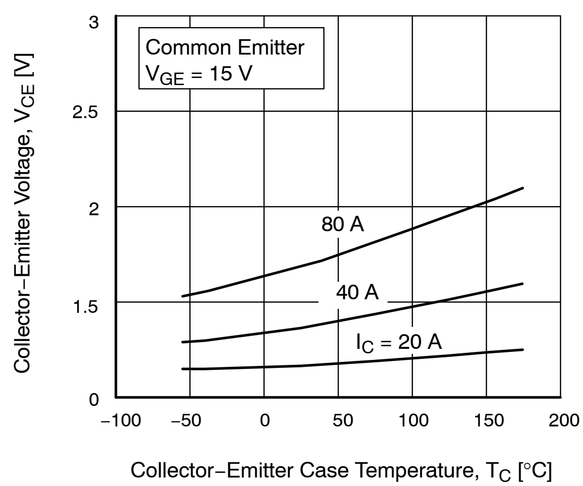


Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level

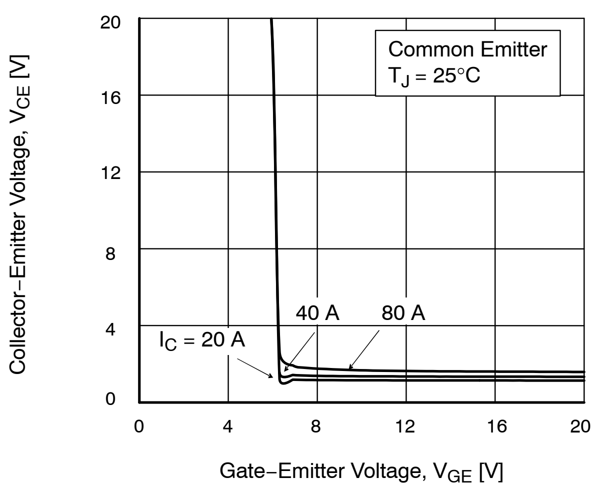


Figure 5. Saturation Voltage vs V_{GE}

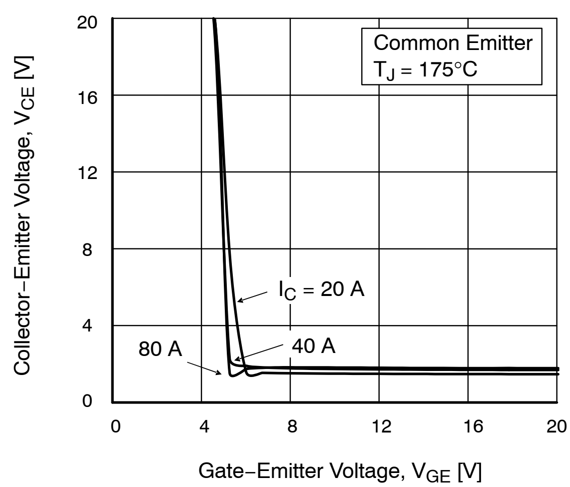


Figure 6. Saturation Voltage vs V_{GE}

TYPICAL CHARACTERISTICS (continued)

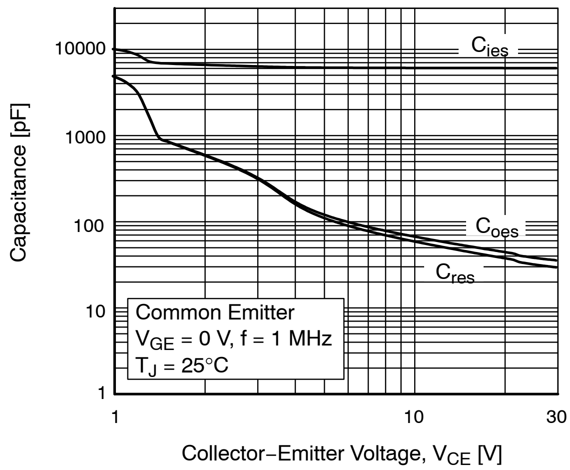


Figure 7. Capacitance Characteristics

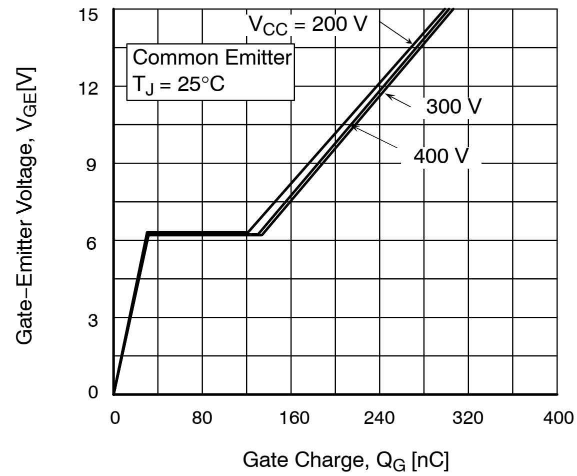


Figure 8. Gate Charge Characteristics

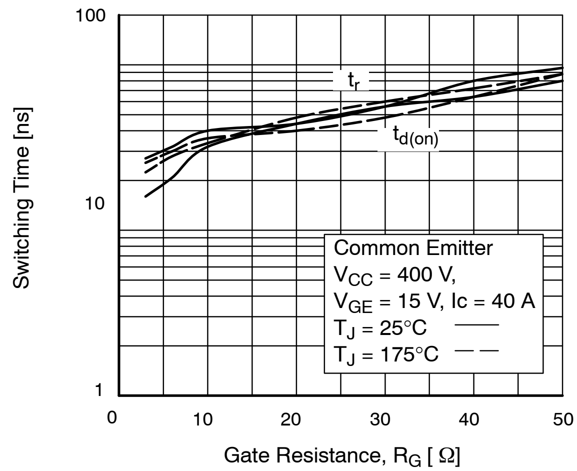


Figure 9. Turn−on Characteristics vs. Gate Resistance

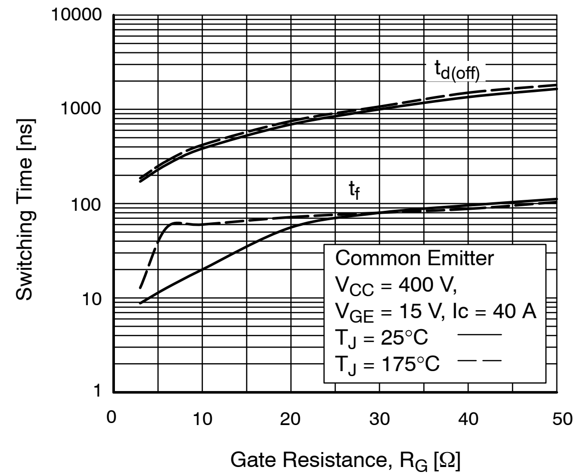


Figure 10. Turn−Off Characteristics vs. Gate Resistance

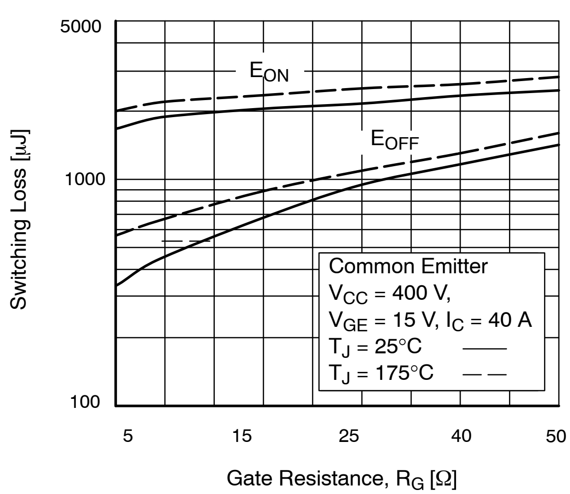


Figure 11. Switching Loss vs Gate Resistance

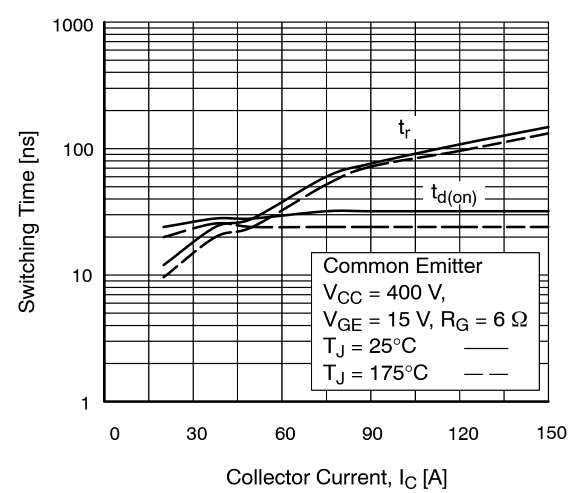


Figure 12. Turn−On Characteristics vs. Collector Current

TYPICAL CHARACTERISTICS (continued)

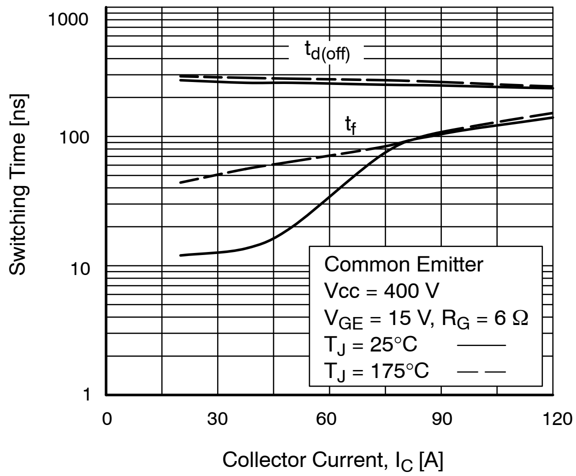


Figure 13. Turn−Off Characteristics vs. Collector Current

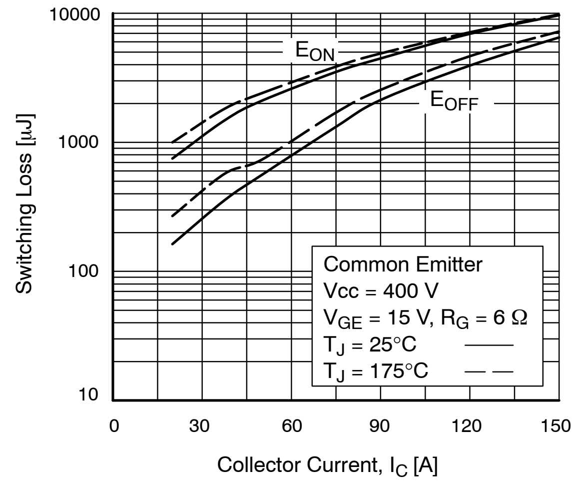


Figure 14. Switching Loss vs. Collector Current

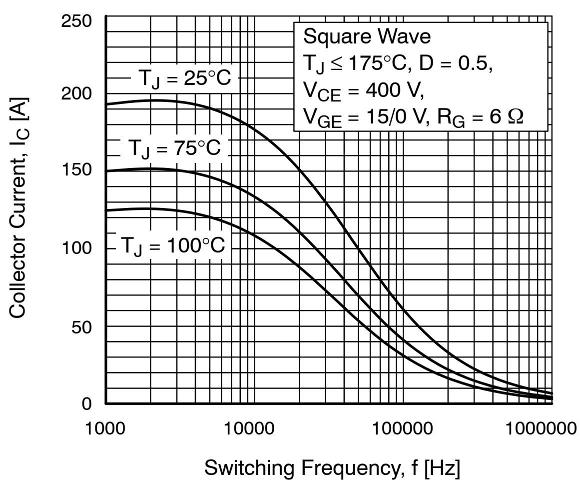


Figure 15. Load Current vs Frequency

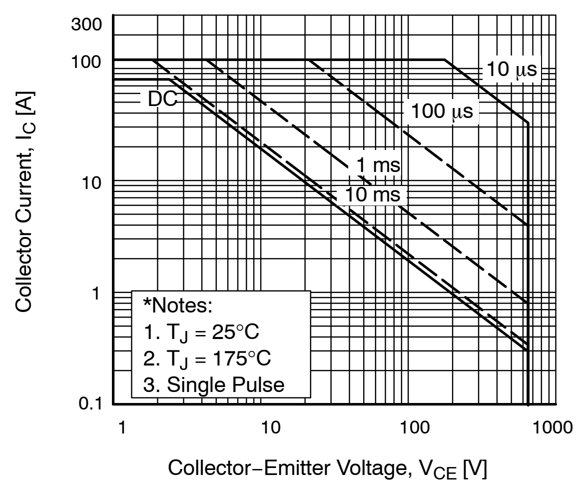


Figure 16. SOA Characteristics (FBSOA)

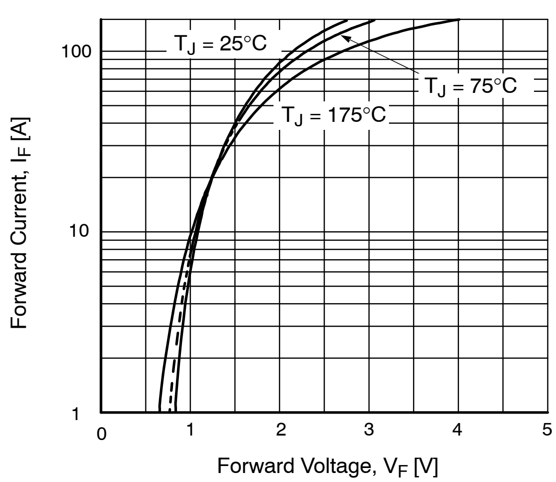


Figure 17. Forward Characteristics

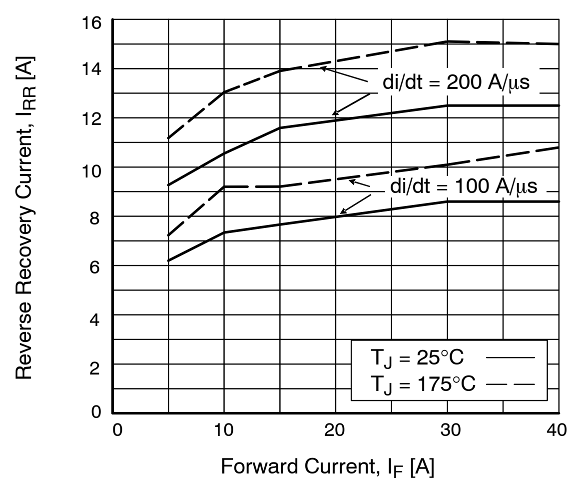


Figure 18. Reverse Recovery Current

TYPICAL CHARACTERISTICS (continued)

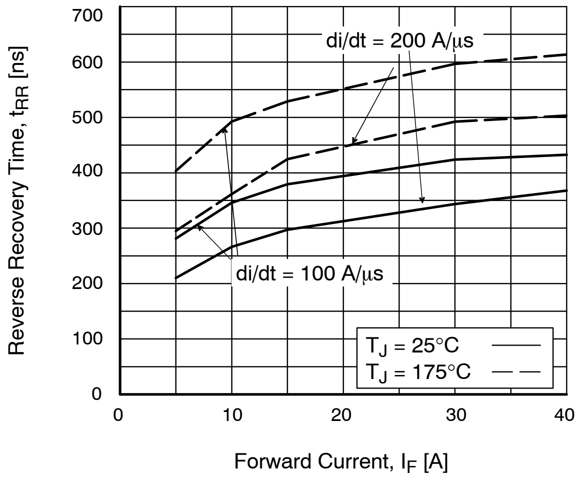


Figure 19. Reverse Recovery Time

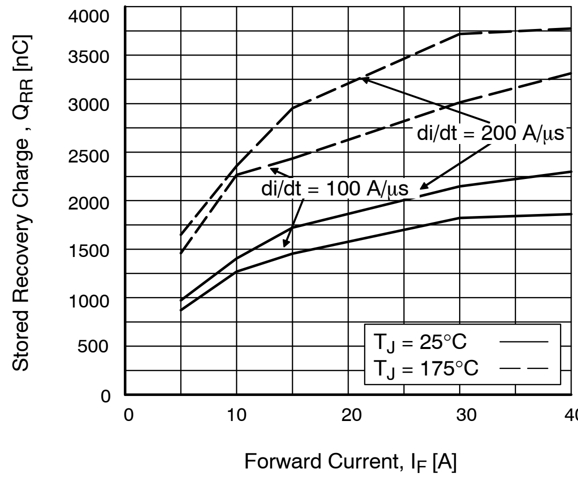


Figure 20. Stored Charge

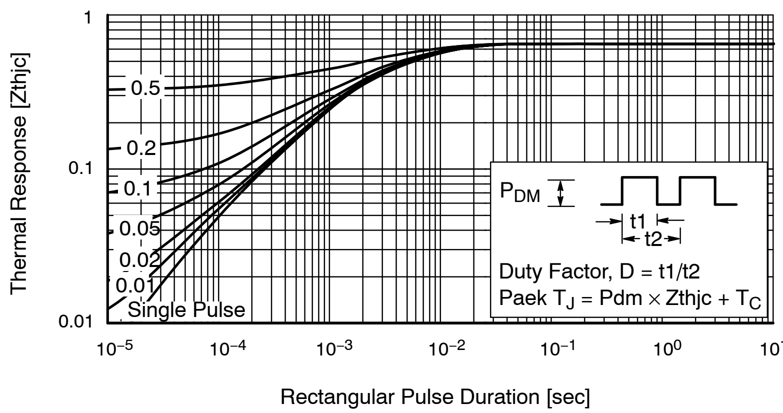


Figure 21. Transient Thermal Impedance of IGBT

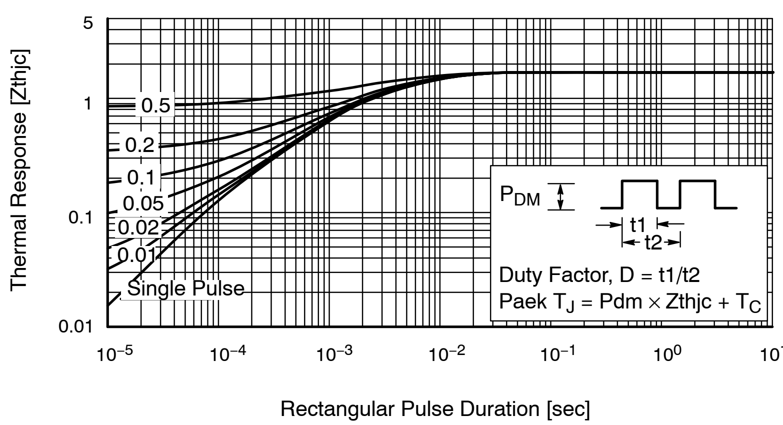
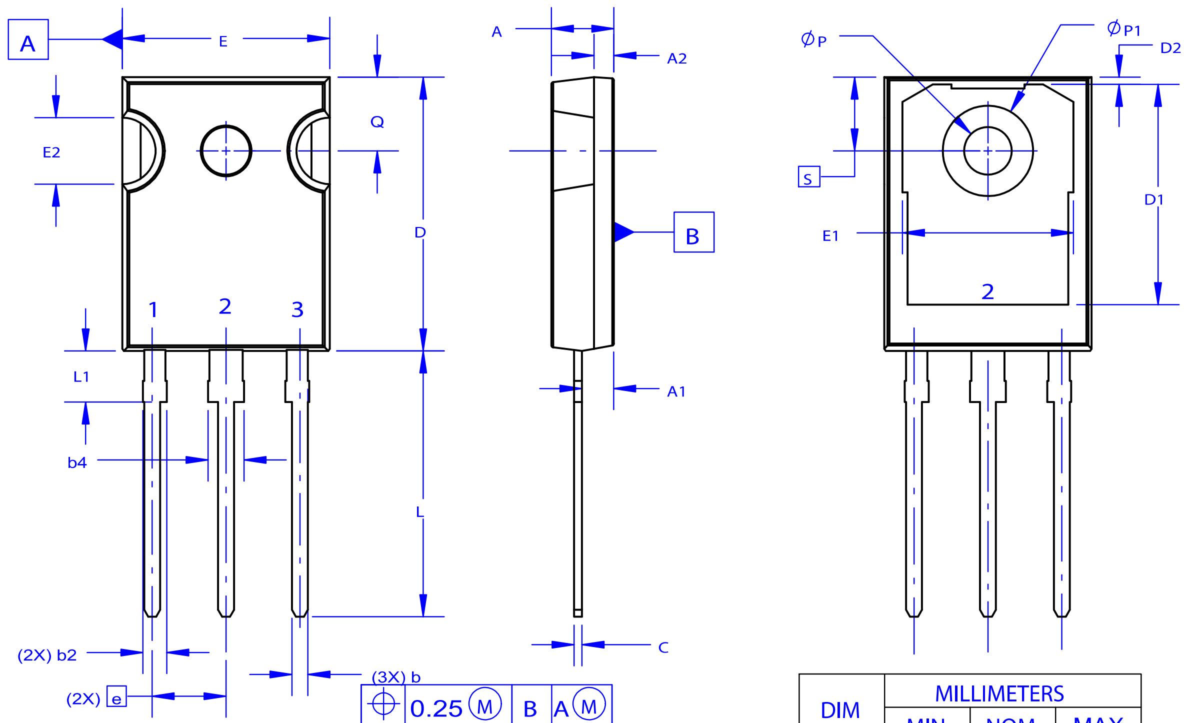


Figure 22. Transient Thermal Impedance of Diode

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
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

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative