IGBT - Field Stop

600 V, 60 A

FGH60N60SFDTU-F085

ON Semiconductor®

www.onsemi.com

Description

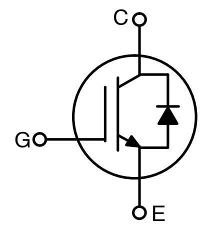
Using Novel Field Stop IGBT Technology, ON Semiconductor's new series of Field Stop IGBTs offer the optimum performance for Automotive Chargers, Inverter, and other applications where low conduction and switching losses are essential.

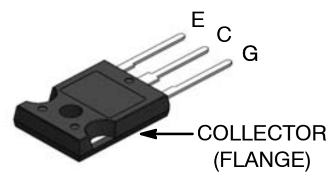
Features

- High Current Capability
- Low Saturation Voltage: $V_{CE(sat)} = 2.2$ V @ $I_C = 60$ A
- High Input Impedance
- Fast Switching
- Qualified to Automotive Requirements of AEC−Q101
- This Device is Pb−Free and is RoHS Compliant

Applications

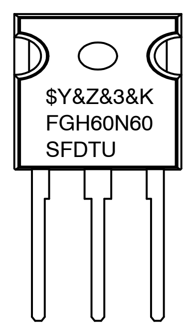
- Automotive chargers, Converters, High Voltage Auxiliaries
- Inverters, PFC, UPS





TO−247−3LD
CASE 340CK

MARKING DIAGRAM



$Y	= ON Semiconductor Logo
&Z	= Assembly Plant Code
&3	= Numeric Date Code
&K	= Lot Code
FGH60N60SFDTU	= 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}	600	V
Gate to Emitter Voltage		V_{GES}	±20	V
Transient Gate−to−Emitter Voltage			±30	V
Collector Current	T_C = 25°C	I_C	120	A
	T_C = 100°C		60	A
Pulsed Collector Current	T_C = 25°C	I_{CM} (Note 1)	180	A
Maximum Power Dissipation	T_C = 25°C	P_D	378	W
	T_C = 100°C		151	W
Operating Junction Temperature		T_J	−55 to +150	°C
Storage Temperature Range		T_{stg}	−55 to +150	°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 test, Pulse width limited by max. junction temperature.

THERMAL CHARACTERISTICS

Parameter	Symbol	Typ	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$(IGBT)	0.33	°C/W
Thermal Resistance, Junction to Case	$R_{\theta JC}$(Diode)	1.1	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	40	°C/W

PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FGH60N60SFDTU−F085	FGH60N60SFDTU	TO−247	Tube	N/A	N/A	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 = 250 μA	600	–	–	V
Temperature Coefficient of Breakdown Voltage	$\Delta BV_{CES}/\Delta T_J$	V_{GE} = 0 V, I_C = 250 μA	–	0.4	–	V/°C
Collector Cut−Off Current	I_{CES}	$V_{CE} = V_{CES}$, V_{GE} = 0 V	–	–	250	μA
G−E Leakage Current	I_{GES}	$V_{GE} = V_{GES}$, V_{CE} = 0 V	–	–	±400	nA
ON CHARACTERISTICs						
G−E Threshold Voltage	$V_{GE(th)}$	I_C = 250 μA, $V_{CE} = V_{GE}$	4.0	5.1	6.6	V
Collector to Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 60 A, V_{GE} = 15 V	–	2.2	2.9	V
		I_C = 60 A, V_{GE} = 15 V, T_C = 125°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	–	2940	–	pF
Output Capacitance	C_{oes}		–	310	–	pF
Reverse Transfer Capacitance	C_{res}		–	100	–	pF
SWITCHING CHARACTERISTICS						
Turn−On Delay Time	$t_{d(on)}$	V_{CC} = 400 V, I_C = 60 A, R_G = 5 Ω, V_{GE} = 15 V, Inductive Load, T_C = 25°C	–	26	–	ns
Rise Time	t_r		–	54	–	ns
Turn−Off Delay Time	$t_{d(off)}$		–	134	–	ns
Fall Time	t_f		–	18	62	ns
Turn−On Switching Loss	E_{on}		–	1.97	–	mJ
Turn−Off Switching Loss	E_{off}		–	0.57	–	mJ
Total Switching Loss	E_{ts}			2.54	–	mJ
Turn−On Delay Time	$t_{d(on)}$	V_{CC} = 400 V, I_C = 60 A, R_G = 5 Ω, V_{GE} = 15 V, Inductive Load, T_C = 125°C	–	26	–	ns
Rise Time	t_r		–	50	–	ns
Turn−Off Delay Time	$t_{d(off)}$		–	142	–	ns
Fall Time	t_f		–	24	–	ns
Turn−On Switching Loss	E_{on}		–	2.5	–	mJ
Turn−Off Switching Loss	E_{off}		–	0.8	–	mJ
Total Switching Loss	E_{ts}		–	3.2	–	mJ
Total Gate Charge	Q_g	V_{CE} = 400 V, I_C = 60 A, V_{GE} = 15 V	–	188	–	nC
Gate to Emitter Charge	Q_{ge}		–	21	–	nC
Gate to Collector Charge	Q_{gc}		–	98	–	nC

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

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
V_{FM}	Diode Forward Voltage	I_F = 30 A	T_C = 25°C	–	1.9	2.6	V
			T_C = 125°C	–	1.7	–	
t_{rr}	Diode Reverse Recovery Time	I_F = 30 A, di_F/dt = 200 A/μs	T_C = 25°C	–	55	–	ns
			T_C = 125°C	–	204	–	
Q_{rr}	Diode Reverse Recovery Charge		T_C = 25°C	–	125	–	nC
			T_C = 125°C	–	895	–	

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

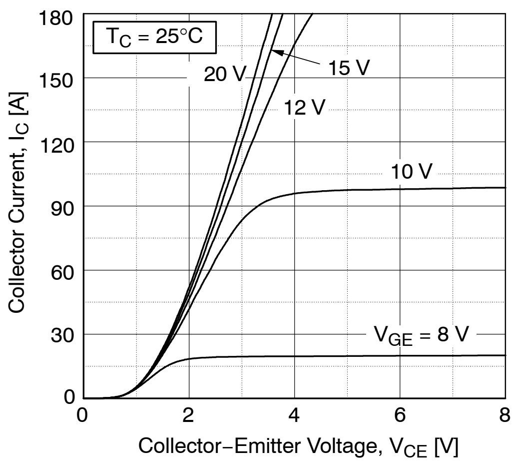


Figure 1. Typical Output Characteristics

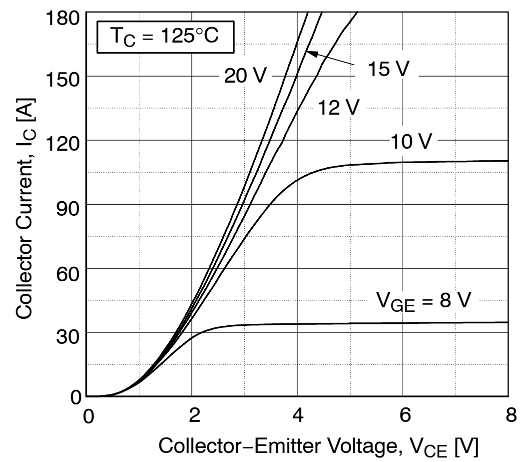


Figure 2. Typical Output Characteristics

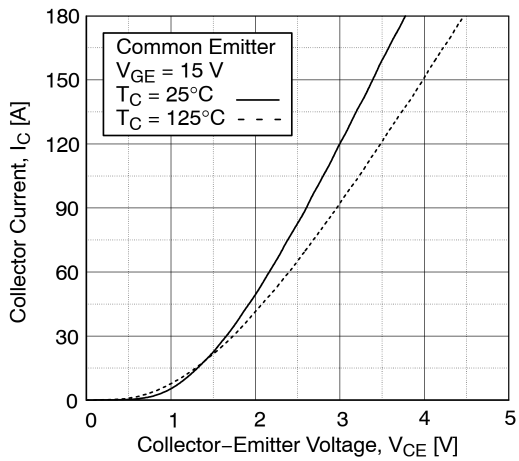


Figure 3. Typical Saturation Voltage Characteristics

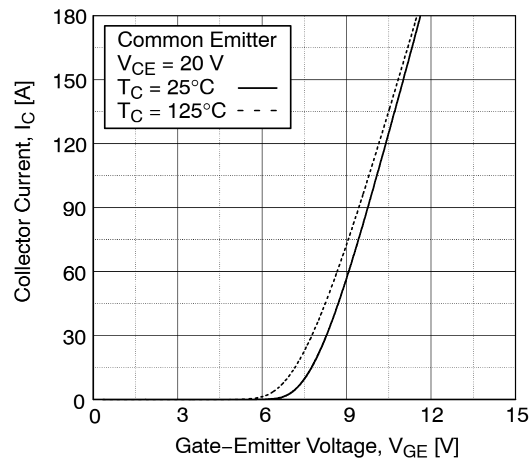


Figure 4. Transfer Characteristics

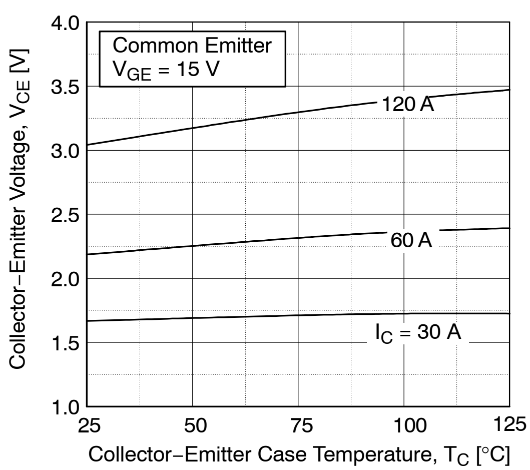


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

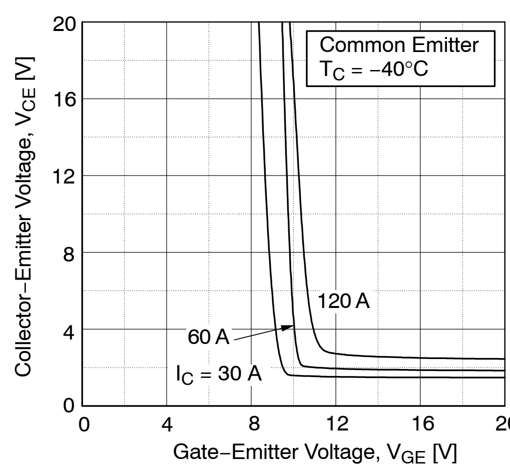


Figure 6. Saturation Voltage vs V_{GE}

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

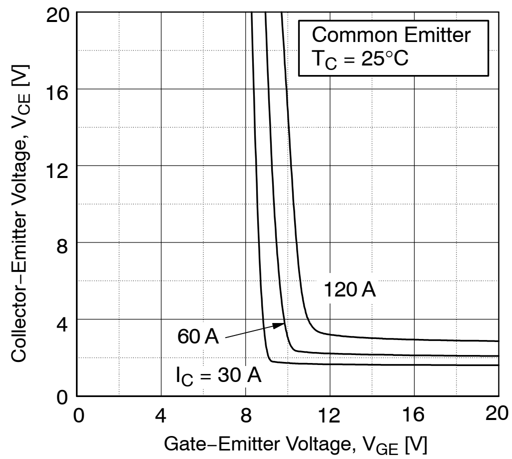


Figure 7. Saturation Voltage vs. V_{GE}

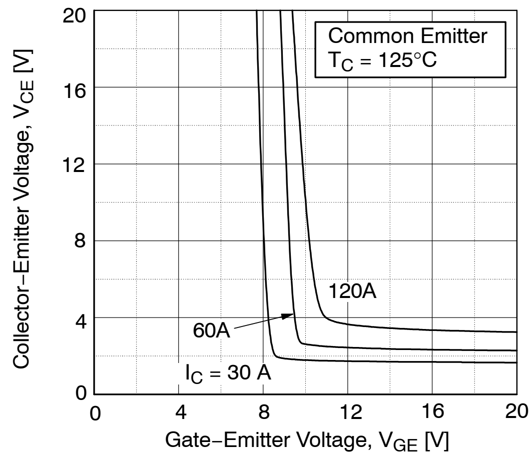


Figure 8. Saturation Voltage vs. V_{GE}

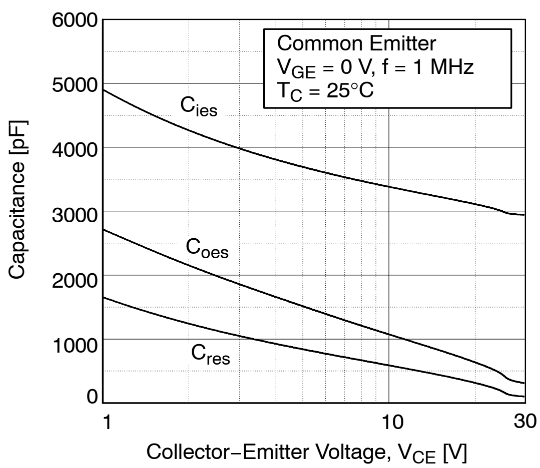


Figure 9. Capacitance Characteristics

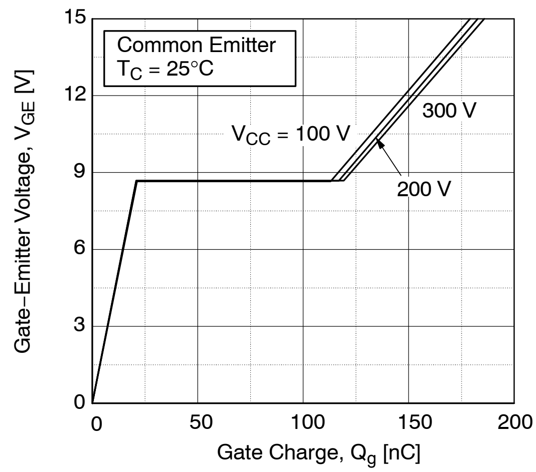


Figure 10. Gate Charge Characteristics

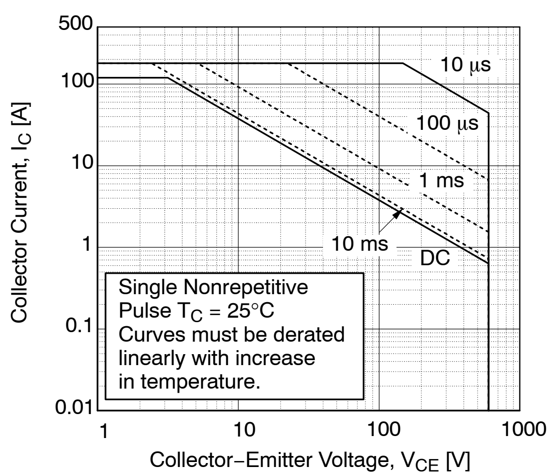


Figure 11. SOA Characteristics

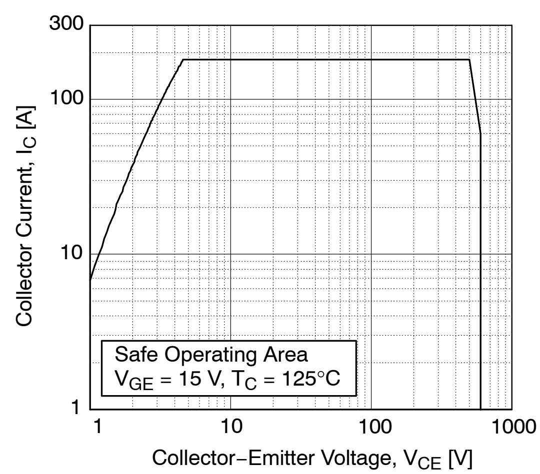


Figure 12. Turn−Off Switching SOA Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

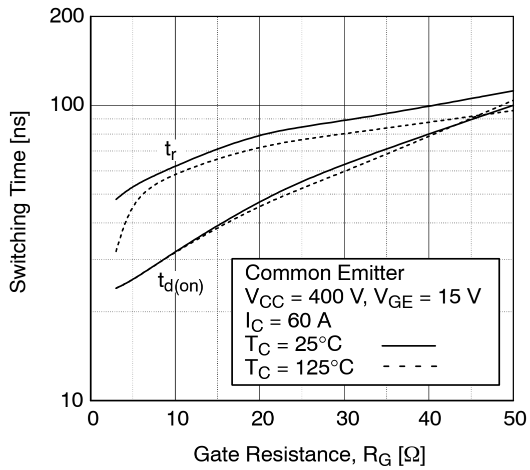


Figure 13. Turn−On Characteristics vs. Gate Resistance

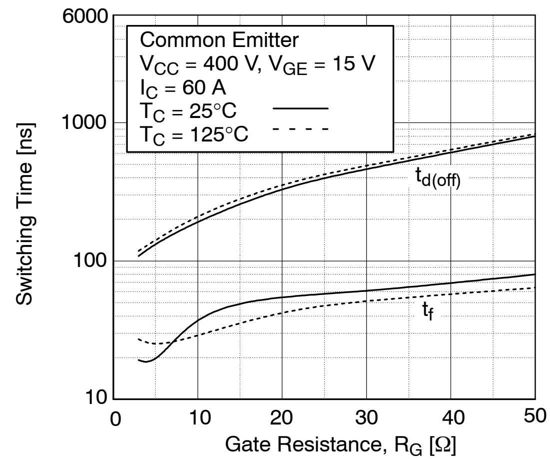


Figure 14. Turn−Off Characteristics vs. Gate Resistance

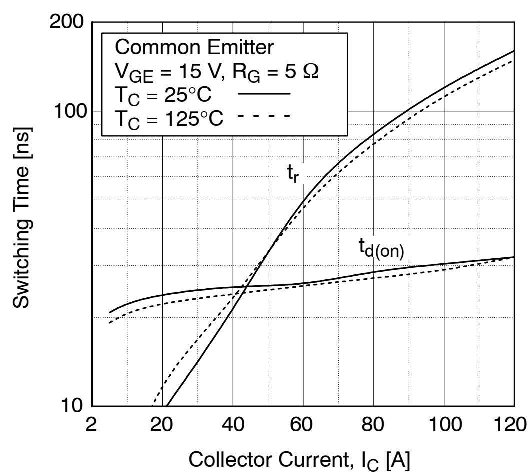


Figure 15. Turn−On Characteristics vs. Collector Current

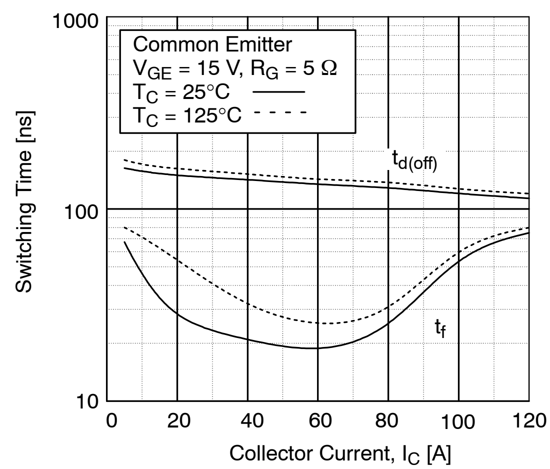


Figure 16. Turn−Off Characteristics vs. Collector Current

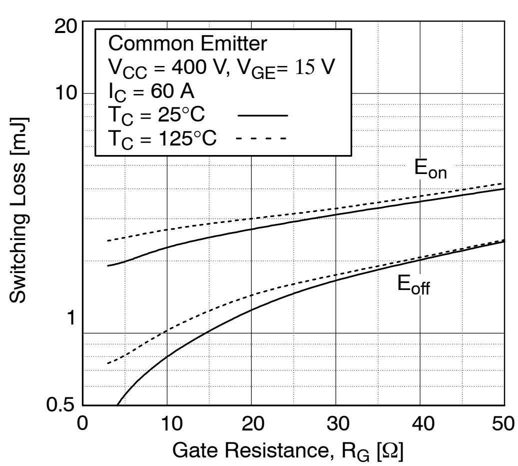


Figure 17. Switching Loss vs. Gate Resistance

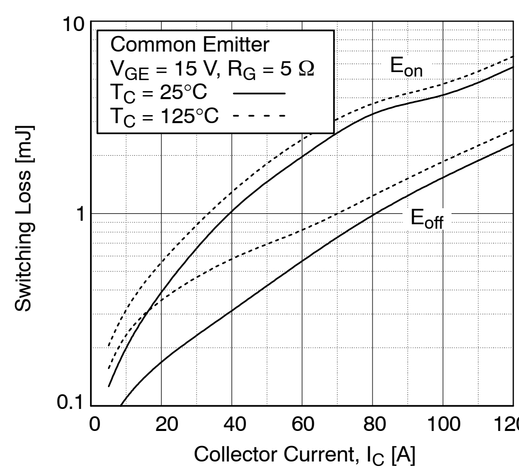


Figure 18. Switching Loss vs. Collector Current

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

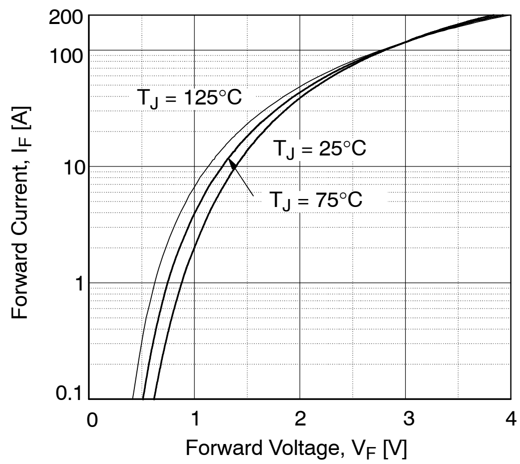


Figure 19. Forward Characteristics

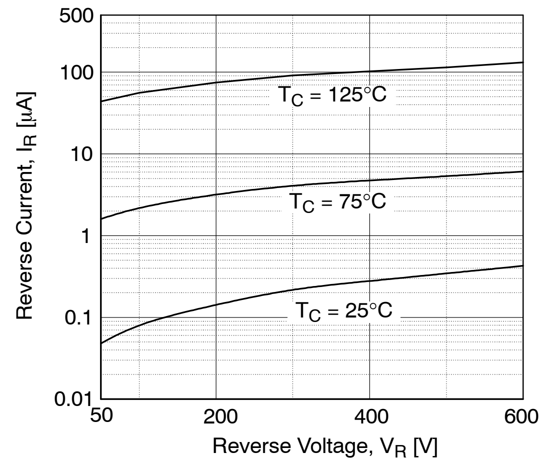


Figure 20. Reverse Current

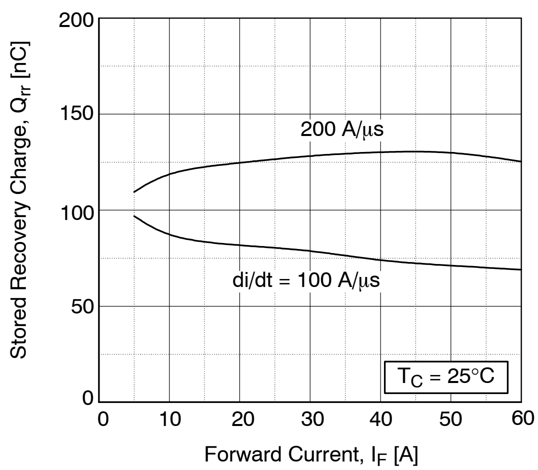


Figure 21. Stored Charge

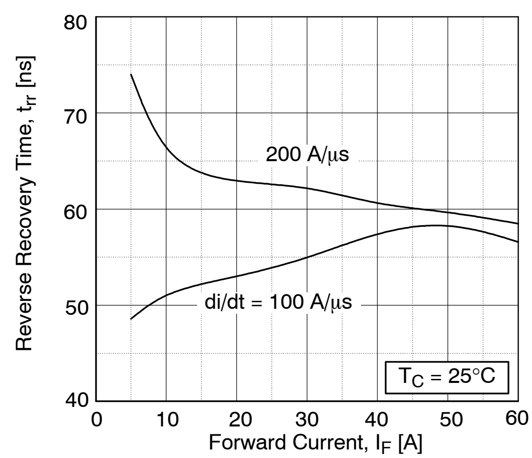


Figure 22. Reverse Recovery Time

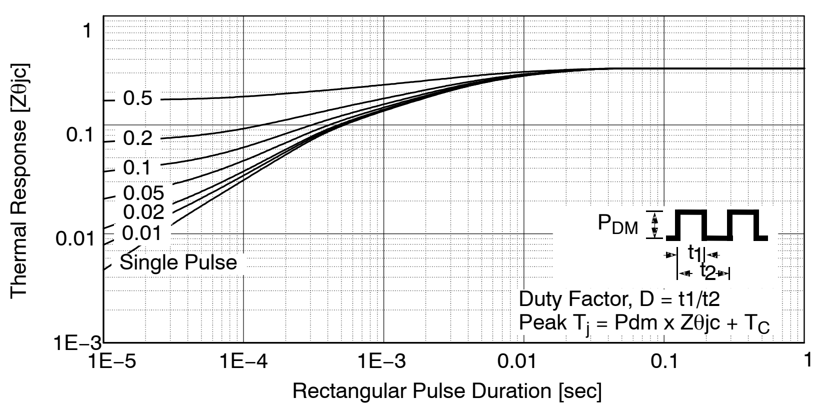
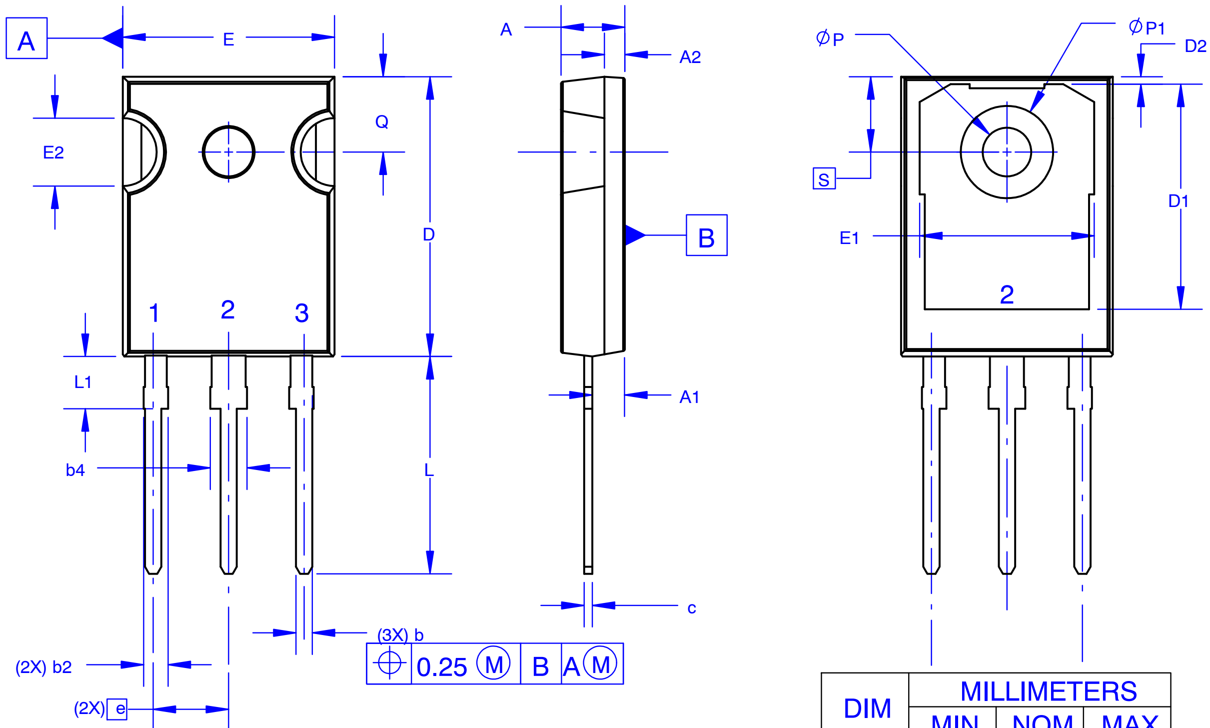


Figure 23. Transient Thermal Impedance of IGBT

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

DATE 31 JAN 2019



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
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*

AYWWZZ
XXXXXXX
XXXXXXX

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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DESCRIPTION:	TO−247−3LD SHORT LEAD	PAGE 1 OF 1

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For additional information, please contact your local Sales Representative