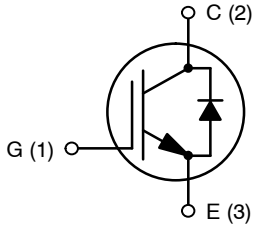
IGBT for Automotive Application

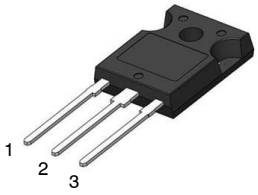
650 V, 50 A

AFGHL50T65RQDN

Using novel field stop IGBT technology, **onsemi**'s new series of field stop 4th generation IGBTs offer the optimum performance for automotive applications. This technology is Short circuit rated and offers high figure of merit with low conduction and switching losses.

50 A, 650 V,
$V_{CE(Sat)}$ = 1.6 V (Typ.)





TO-247-3L
CASE 340CX

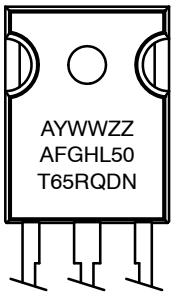
Features

- Maximum Junction Temperature: T_J = 175 °C
- Positive Temperature Co-efficient for Easy Parallel Operation
- High Current Capability
- Low Saturation Voltage: $V_{CE(Sat)}$ = 1.6 V (Typ.) @ I_C = 50 A
- 100% of the Parts Tested for I_{LM} (Note 2)
- High Input Impedance
- Fast Switching
- Tightened Parameter Distribution
- AEC-Q101 Qualified
- This Device is Pb-Free and RoHS Compliant

Typical Applications

- E-compressor for HEV/EV, PTC Heater for HEV/EV

MARKING DIAGRAM



A = Assembly Site
WW = Work Week Number
Y = Year of Production, Last Number
ZZ = Assembly Lot Number
AFGHL50T65RQDN = Specific Device Code

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 (Note 1) @ T_C = 25 °C @ T_C = 100 °C	I_C	 78 50	A
Pulsed Collector Current (Note 2)	I_{LM}	150	A
Pulsed Collector Current (Note 3)	I_{CM}	150	A
Diode Forward Current (Note 1) @ T_C = 25 °C @ T_C = 100 °C	I_F	 54 40	A
Pulsed Diode Maximum Forward Current	I_{FM}	160	A
Non-Repetitive Forward Surge Current (Half-Sine Pulse, tp = 8.3 ms, T_C = 25 °C) (Half-Sine Pulse, tp = 8.3 ms, T_C = 50 °C)	I_{FM}	 160 140	A
Short Circuit Withstand Time V_{GE} = 15 V, V_{CC} = 400 V, $T_J \le$ 150°C	t_{SC}	 5	μs
Maximum Power Dissipation @ T_C = 25 °C @ T_C = 100 °C	P_D	 346 173	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 s	T_L	265	°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. Value limited by bond wire.
2. V_{CC} = 600 V, V_{GE} = 15 V, I_C = 200 A, R_G = 9 Ω, Inductive Load, 100% Tested.
3. Repetitive Rating: pulse width limited by max. Junction temperature.

ORDERING INFORMATION

Device	Package	Shipping
AFGHL50T65RQDN	TO-247-3L (Pb-Free)	30 Units / Rail

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THERMAL CHARACTERISTICS

Rating	Symbol	Min	Typ	Max	Unit
Thermal Resistance Junction-to-Case, for IGBT	$R_{\theta JC}$		0.33	0.43	°C/W
Thermal Resistance Junction-to-Case, for Diode	$R_{\theta JC}$		0.82	1.06	
Thermal Resistance Junction-to-Ambient	$R_{\theta JA}$			40	

ELECTRICAL CHARACTERISTICS (T_J = 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 = 1 mA	BV_{CES}	650			V
Temperature Coefficient of Breakdown Voltage	V_{GE} = 0 V, I_C = 1 mA	$\frac{\Delta BV_{CES}}{\Delta T_J}$		0.6		V/°C
Collector-emitter Cut-off Current, Gate-emitter Short-circuited	V_{GE} = 0 V, V_{CE} = V_{CES}	I_{CES}			30	μA
Gate Leakage Current, Collector-emitter Short-circuited	V_{GE} = V_{GES}, V_{CE} = 0 V	I_{GES}			±400	nA
ON CHARACTERISTICS						
Gate-emitter Threshold Voltage	V_{GE} = V_{CE}, I_C = 50 mA	$V_{GE(th)}$	3.2	5.0	6.0	V
Collector-emitter Saturation Voltage	V_{GE} = 15 V, I_C = 50 A, T_J = 25 °C V_{GE} = 15 V, I_C = 50 A, T_J = 175 °C	$V_{CE(sat)}$		1.6 1.9	1.81	V
DYNAMIC CHARACTERISTICS						
Input Capacitance	V_{CE} = 30 V, V_{GE} = 0 V, f = 1 MHz	C_{ies}		2533		pF
Output Capacitance		C_{oes}		81		
Reverse Transfer Capacitance		C_{res}		11		
Gate Resistance	f = 1 MHz	R_g		15.06		Ω
Gate Charge Total	V_{CC} = 400 V, I_C = 50 A, V_{GE} = 15 V	Q_g		65		nC
Gate-Emitter Charge		Q_{ge}		19		
Gate-Collector Charge		Q_{gc}		18		
SWITCHING CHARACTERISTICS, INDUCTIVE LOAD						
Turn-on Delay Time	T_J = 25 °C, V_{CC} = 400 V, I_C = 25 A, R_G = 2.5 Ω, V_{GE} = 15 V, Inductive Load	$t_{d(on)}$		38		ns
Rise Time		t_r		23		
Turn-off Delay Time		$t_{d(off)}$		78		
Fall Time		t_f		82		
Turn-on Switching Loss		E_{on}		1.14		mJ
Turn-off Switching Loss		E_{off}		0.411		
Total Switching Loss		E_{ts}		1.58		
Turn-on Delay Time	T_J = 25 °C, V_{CC} = 400 V, I_C = 50 A, R_G = 2.5 Ω, V_{GE} = 15 V, Inductive Load	$t_{d(on)}$		41		ns
Rise Time		t_r		40		
Turn-off Delay Time		$t_{d(off)}$		76		
Fall Time		t_f		64		
Turn-on Switching Loss		E_{on}		3.09		mJ
Turn-off Switching Loss		E_{off}		0.83		
Total Switching Loss		E_{ts}		3.92		

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ELECTRICAL CHARACTERISTICS (T_J = 25 °C unless otherwise noted) (Continued)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS, INDUCTIVE LOAD						
Turn-on Delay Time	T_J = 175 °C, V_{CC} = 400 V, I_C = 25 A, R_G = 2.5 Ω, V_{GE} = 15 V, Inductive Load	$t_{d(on)}$		38		ns
Rise Time		t_r		27		
Turn-off Delay Time		$t_{d(off)}$		92		
Fall Time		t_f		165		
Turn-on Switching Loss		E_{on}		1.26		mJ
Turn-off Switching Loss		E_{off}		0.99		
Total Switching Loss		E_{ts}		2.26		
Turn-on Delay Time	T_J = 175 °C, V_{CC} = 400 V, I_C = 50 A, R_G = 2.5 Ω, V_{GE} = 15 V, Inductive Load	$t_{d(on)}$		45		ns
Rise Time		t_r		46		
Turn-off Delay Time		$t_{d(off)}$		86		
Fall Time		t_f		133		
Turn-on Switching Loss		E_{on}		3.5		mJ
Turn-off Switching Loss		E_{off}		1.84		
Total Switching Loss		E_{ts}		5.34		
DIODE CHARACTERISTICS						
Diode Forward Voltage	I_F = 40 A, T_J = 25 °C	V_F		1.65	2.20	V
	I_F = 40 A, T_J = 175 °C			1.7		
DIODE SWITCHING CHARACTERISTICS, INDUCTIVE LOAD						
Reverse Recovery Energy	I_F = 40 A, dI_F/dt = 1000 A/μs V_R = 400 V, T_J = 25 °C	E_{rec}		43		μJ
Diode Reverse Recovery Time		T_{rr}		57		nS
Diode Reverse Recovery Charge		Q_{rr}		589		nC
Reverse Recovery Energy	I_F = 40 A, dI_F/dt = 1000 A/μs V_R = 400 V, T_J = 175 °C	E_{rec}		215		μJ
Diode Reverse Recovery Time		T_{rr}		118		nS
Diode Reverse Recovery Charge		Q_{rr}		1552		nC

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.

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TYPICAL CHARACTERISTICS

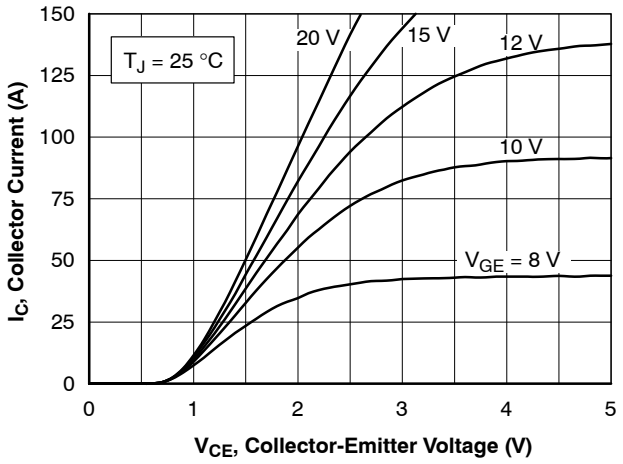


Figure 1. Typical Output Characteristics

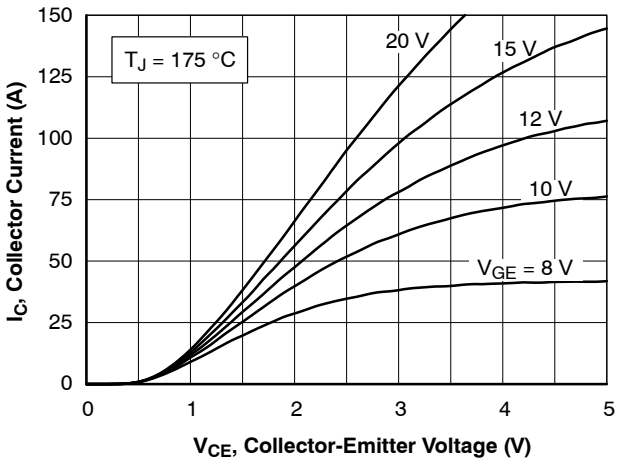


Figure 2. Typical Output Characteristics

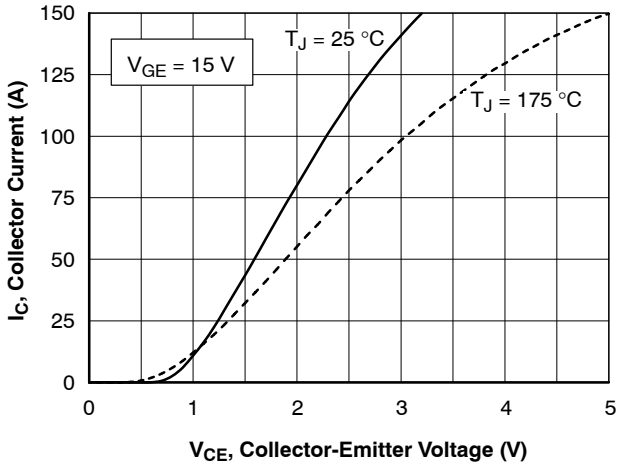


Figure 3. Typical Saturation Voltage Characteristics

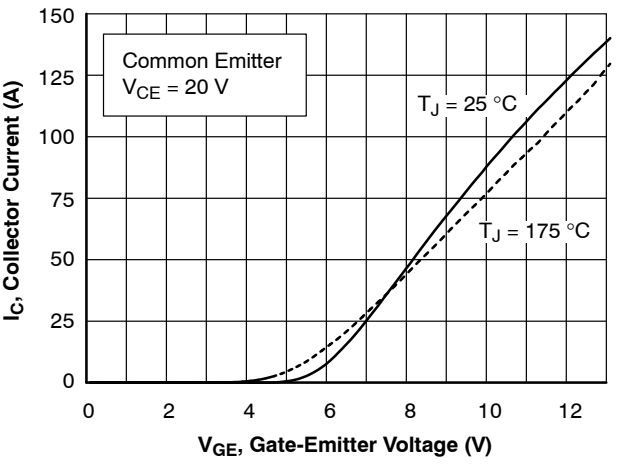


Figure 4. Typical Transfer Characteristics

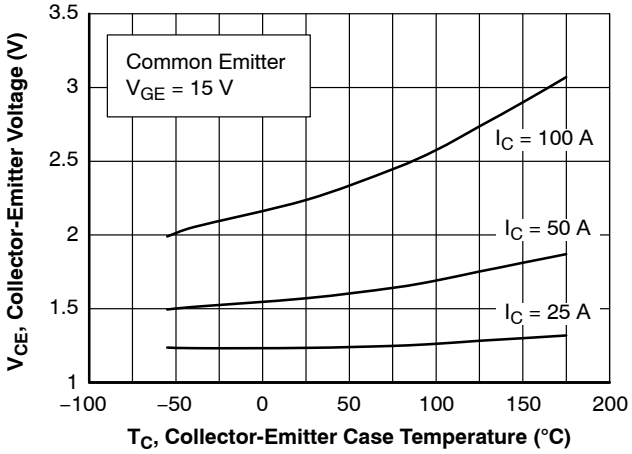


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

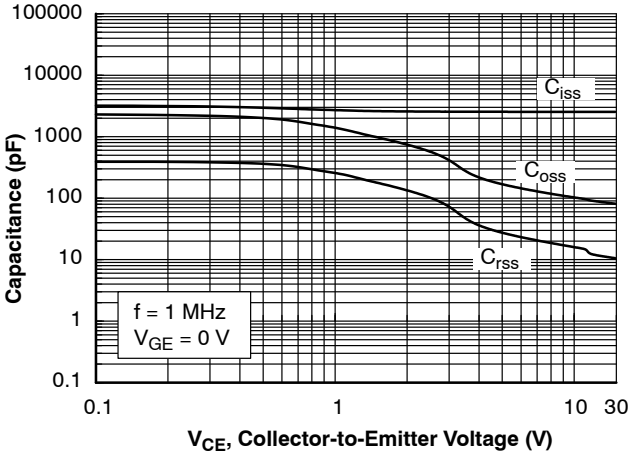


Figure 6. Capacitance Characteristics

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TYPICAL CHARACTERISTICS (Continued)

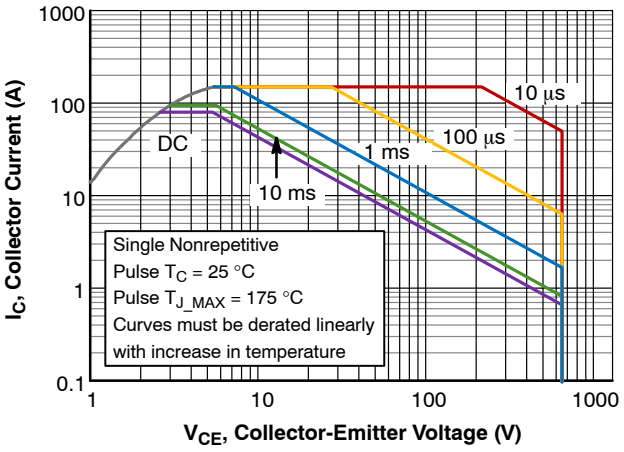


Figure 7. SOA Characteristics

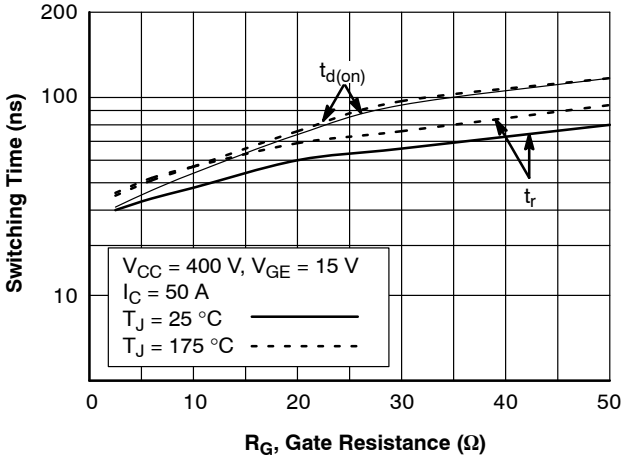


Figure 8. Turn-on Characteristics vs. Gate Resistance

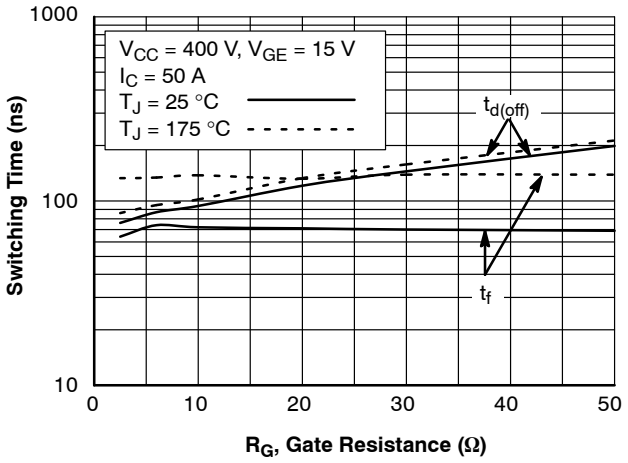


Figure 9. Turn-off Characteristics vs. Gate Resistance

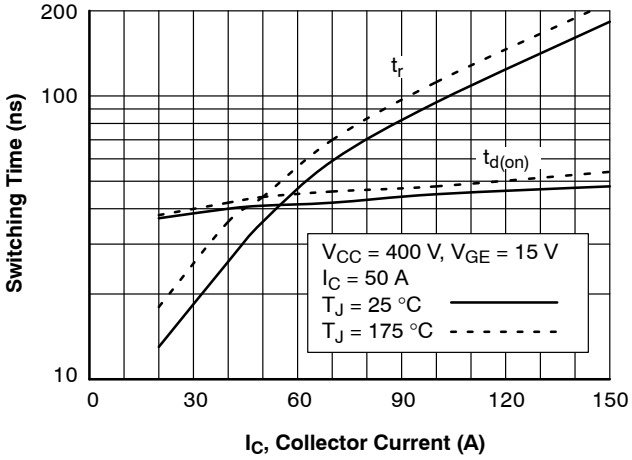


Figure 10. Turn-on Characteristics vs. Collector Current

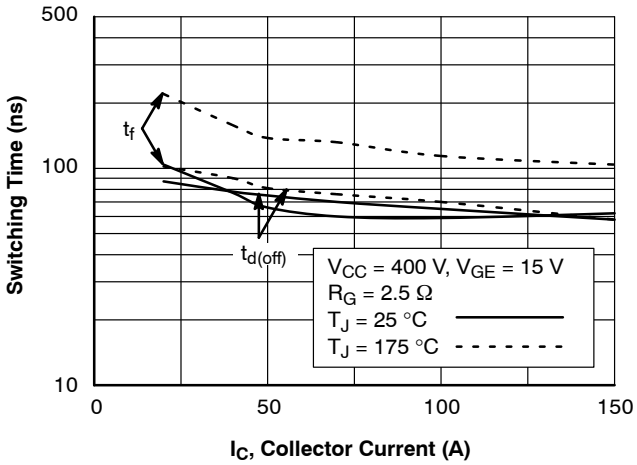


Figure 11. Turn-off Characteristics vs. Collector Current

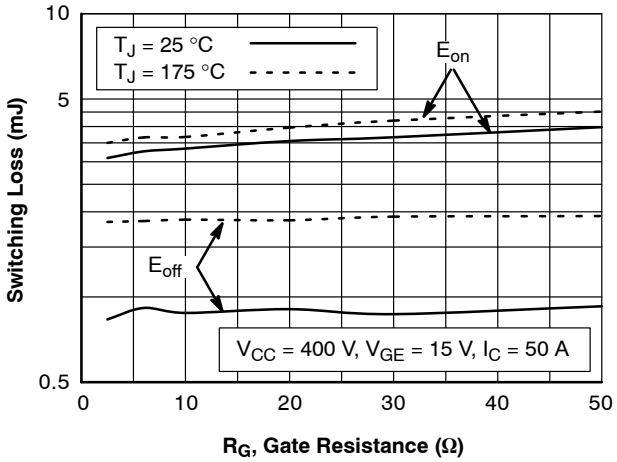


Figure 12. Switching Loss vs. Gate Resistance

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TYPICAL CHARACTERISTICS (Continued)

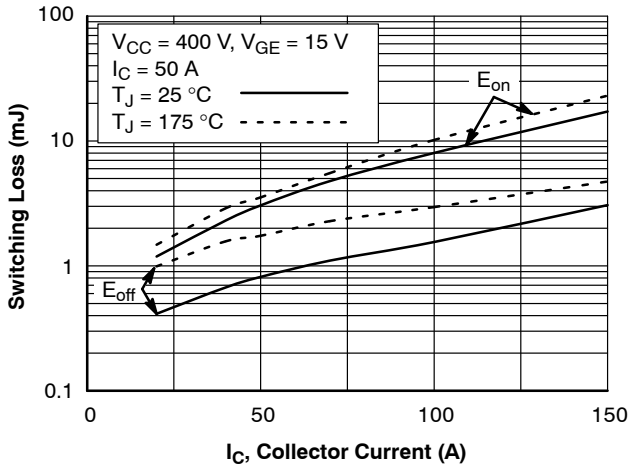


Figure 13. Switching Loss vs. Collector Current

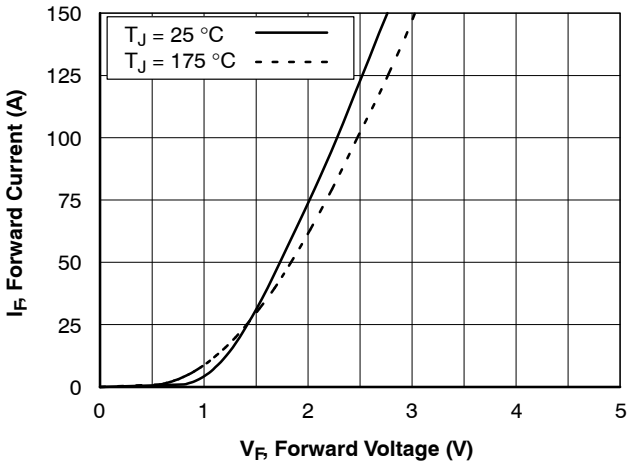


Figure 14. Forward Characteristics

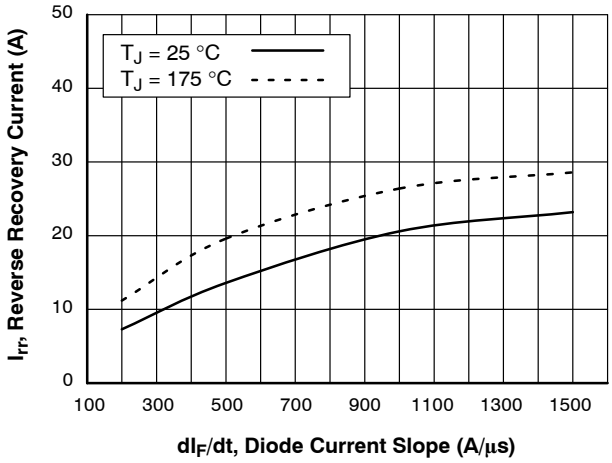


Figure 15. Reverse Recovery Current

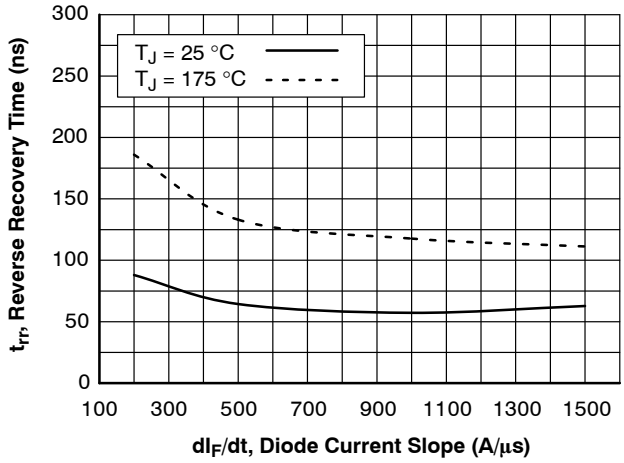


Figure 16. Reverse Recovery Time

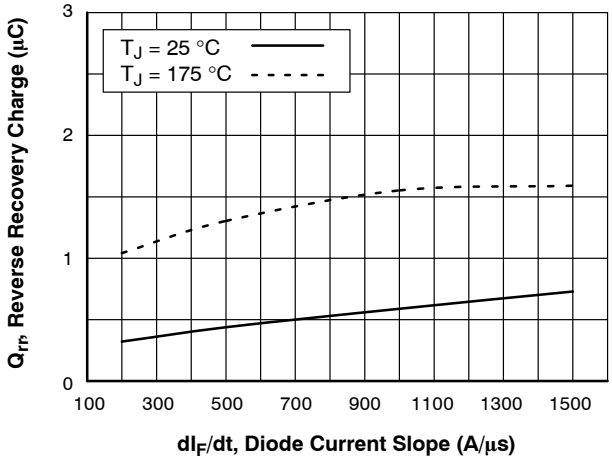


Figure 17. Stored Charge

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TYPICAL CHARACTERISTICS (Continued)

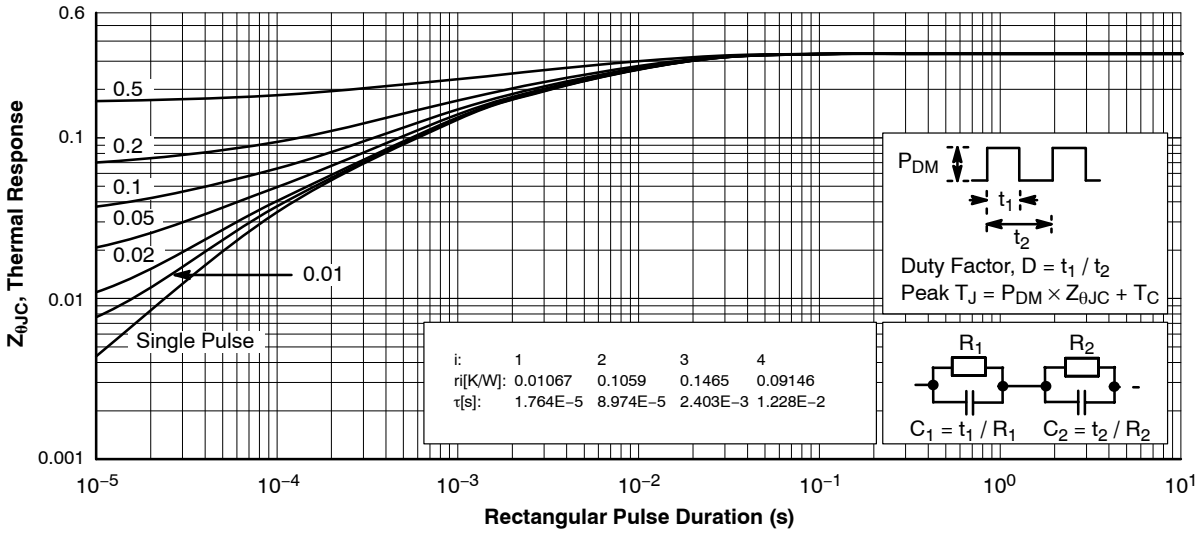


Figure 18. Transient Thermal Impedance of IGBT

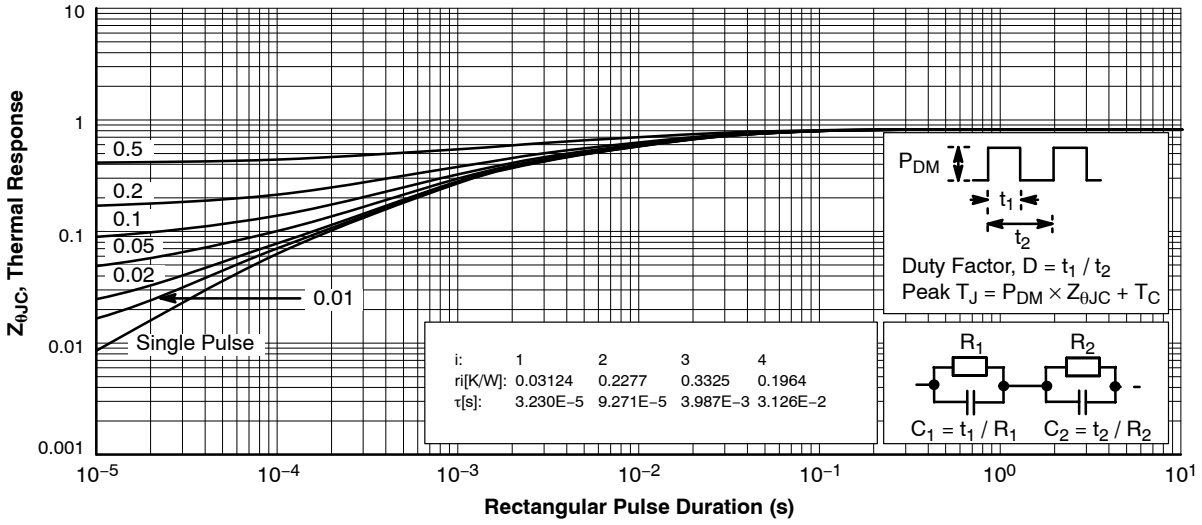


Figure 19. Transient Thermal Impedance of Diode

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REVISION HISTORY

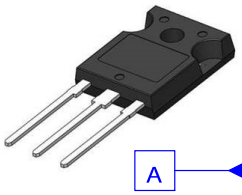
Revision	Description of Changes	Date
4	1. Correction on maximum current for SCR should be 3 times IC rated. 2. Update Figure1−4 and Figure 14 with y-axis up to 3 times IC rated. 3. SOA Figure 7 update. 4. Update Pin connection symbol.	4/20/2026

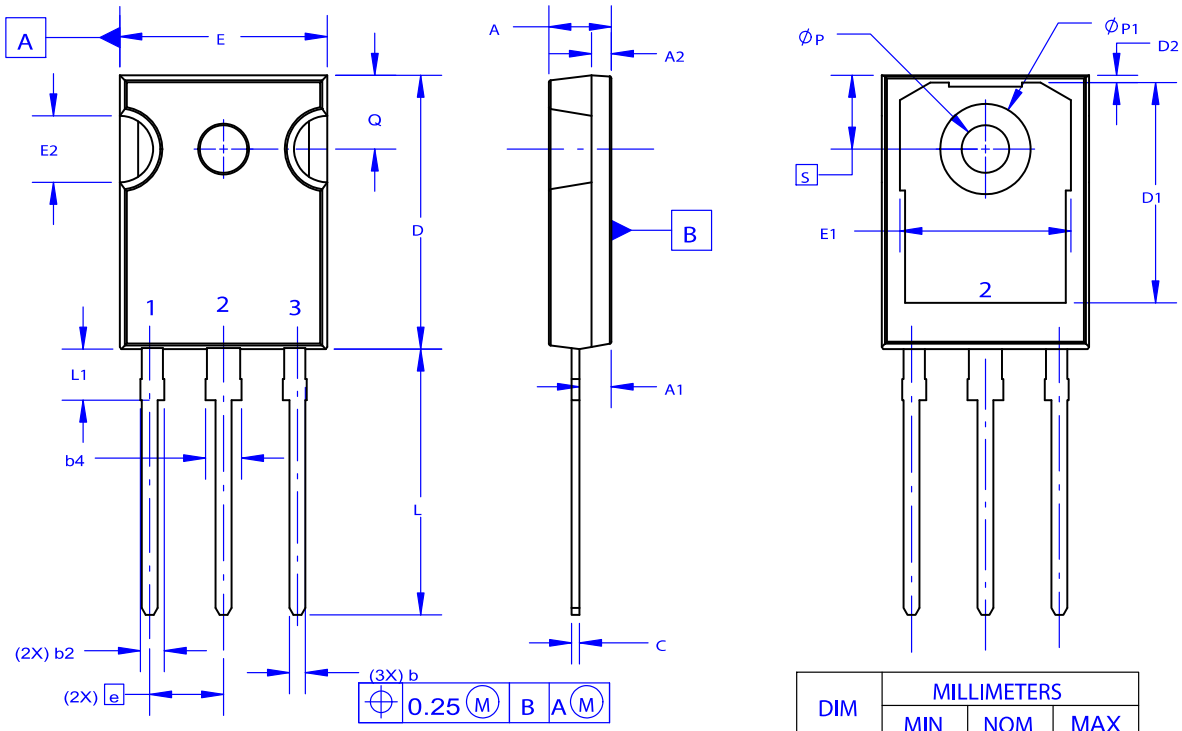
This document has undergone updates prior to the inclusion of this revision history table. The changes tracked here only reflect updates made on the noted approval dates.

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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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For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales

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Üretici parça numarasını yazın; stok ve fiyatı hemen görün.

www.entegreci.com

Ürün kategorileri

Entegreden kapasitöre tüm elektronik komponent kategorileri.

Kategorilere göz atın

Üreticiler

Aradığınız üreticinin ürünlerini tek sayfada inceleyin.

Üreticileri görün

Toplu alım ve teklif

Listede olmayan ya da yüksek adetli parçalar için teklif isteyin.

Teklif isteyin

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