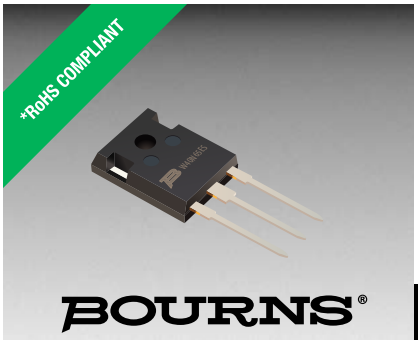


Features

- 650 V, 40 A, Low Collector-Emitter Saturation Voltage ($V_{CE(sat)}$)
- Novel trench-gate field-stop technology
- Optimized for conduction
- Medium-speed switching
- Maximum operating T_j = 175 °C
- RoHS compliant*

Applications

- Switched-Mode Power Supplies (SMPS)
- Uninterruptible Power Sources (UPS)
- Power Factor Correction (PFC)
- Inverters
- Welding converters
- Photovoltaic

BIDW40N65ES5 Insulated Gate Bipolar Transistor (IGBT)

General Information

The Bourns® Model BIDW40N65ES5 IGBT device combines technology from a MOS gate and a bipolar transistor, resulting in an optimum component for high voltage and high current applications. This device uses Trench-Gate Field-Stop technology providing greater control of dynamic characteristics while resulting in a lower Collector-Emitter Saturation Voltage ($V_{CE(sat)}$) and fewer switching losses.

Additional Information

Click these links for more information:

PRODUCT SELECTOR | TECHNICAL LIBRARY | INVENTORY | SAMPLES | CONTACT

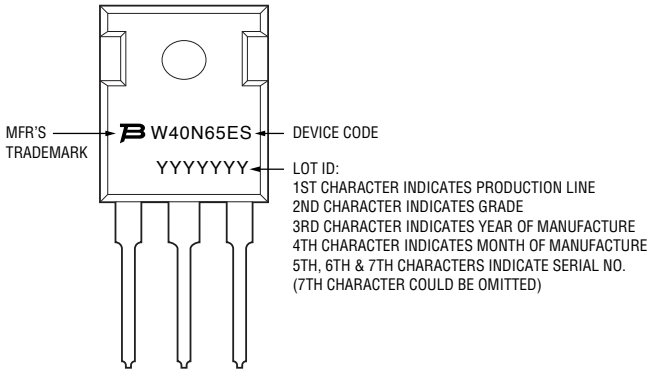
Maximum Electrical Ratings (T_C = 25 °C, unless otherwise specified)

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CES}	650	V
Continuous Collector Current (T_C = 25 °C), limited by T_{jmax}	I_C	80	A
Continuous Collector Current (T_C = 100 °C), limited by T_{jmax}	I_C	40	A
Pulsed Collector Current, t_p limited by T_{jmax}	I_{CP}	160	A
Gate-Emitter Voltage	V_{GE}	±20	V
Gate-Emitter Voltage (t_p ≤10 μs, D < 1 %)	V_{GE}	±30	V
Continuous Forward Current (T_C = 100 °C), limited by T_{jmax}	I_F	40	A
Total Power Dissipation	P_{total}	230	W
Storage Temperature	T_{STG}	-55 to +150	°C
Operating Junction Temperature	T_j	-40 to +175	°C

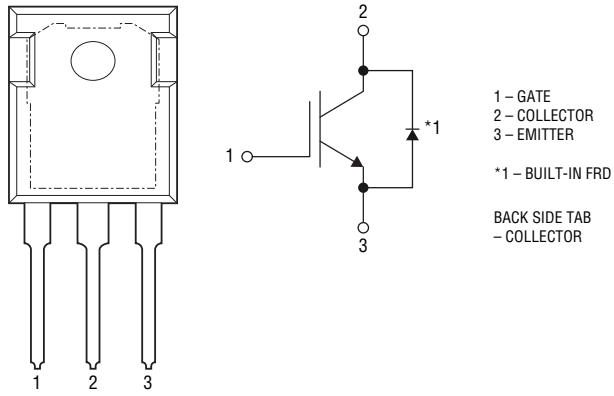
Thermal Resistance

Parameter	Symbol	Max	Unit
IGBT Thermal Resistance Junction - Case	$R_{th(j-c)_IGBT}$	0.65	°C/W
Diode Thermal Resistance Junction - Case	$R_{th(j-c)_Diode}$	0.6	°C/W

Typical Part Marking



Internal Circuit



WARNING Cancer and Reproductive Harm
www.P65Warnings.ca.gov

*RoHS Directive 2015/863, Mar 31, 2015 and Annex.
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Static Electrical Characteristics (T_C = 25 °C, Unless Otherwise Specified)

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Collector-Emitter Breakdown Voltage	BV_{CES}	V_{GE} = 0 V, I_C = 250 μA	650	—	—	V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE} = 15 V, I_C = 40 A, T_C= 25 °C	—	1.35	1.7	V
		V_{GE} = 15 V, I_C = 40 A, T_C= 150 °C	—	1.5	—	
Diode Forward On-Voltage	V_F	I_F = 40 A, T_C = 25 °C	—	1.45	1.9	V
		I_F = 40 A, T_C = 150 °C	—	1.32	—	V
Gate Threshold Voltage	$V_{GE(th)}$	V_{CE} = V_{GE}, I_C = 250 μA	3.2	4.5	5.8	V
Collector Cut-off Current	I_{CES}	V_{GE} = 0 V, V_{CE} = 650 V	—	—	100	μA
Gate-Emitter Leakage Current	I_{GES}	V_{CE} = 0 V, V_{GE} = ± 20 V	—	—	±100	nA

Dynamic Electrical Characteristics (T_C = 25 °C, Unless Otherwise Specified)

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Input Capacitance	C_{ies}	V_{CE} = 30 V, V_{GE} = 0 V, f = 1 MHz	—	2856	—	pF
Output Capacitance	C_{oes}		—	82	—	
Reverse Transfer Capacitance	C_{res}		—	12	—	
Total Gate Charge	Q_g	V_{CE} = 520 V, V_{GE} = 15 V, I_C = 40.0 A	—	107	—	nC
Gate-Emitter Charge	Q_{ge}		—	24	—	
Gate-Collector Charge	Q_{gc}		—	31	—	

IGBT Switching Characteristics (Inductive Load, T_C = 25 °C, unless otherwise specified)

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Turn-on Delay Time	$t_{d(on)}$	V_{CE} = 400 V, V_{GE} = 15 V, I_C = 40.0 A, R_G = 10 Ω	—	28	—	ns
Current Rise Time	t_r		—	26	—	ns
Turn-off Delay Time	$t_{d(off)}$		—	150	—	ns
Current Fall Time	t_f		—	36	—	ns
Turn-on Switching Energy	E_{on}		—	0.58	—	mJ
Turn-off Switching Energy	E_{off}		—	0.63	—	mJ
Total Switching Energy	E_{ts}		—	1.21	—	mJ

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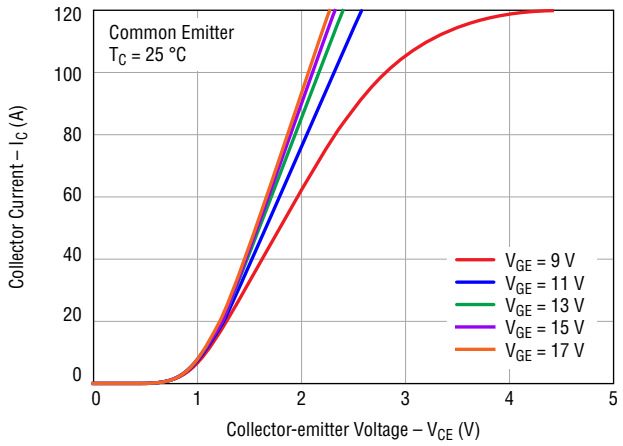
Diode Switching Characteristics (T_C = 25 °C, unless otherwise specified)

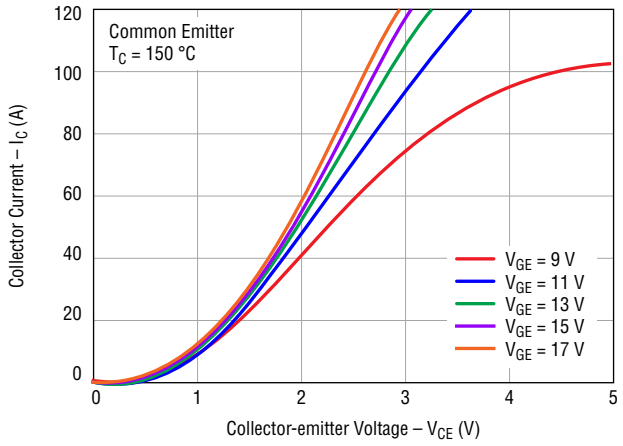
Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Reverse Recovery Time	t_{rr}	dI_F/dt = 200 A/μs, I_F = 40 A	—	106	—	ns
Reverse Recovery Charge	Q_{rr}		—	258	—	nC

Electrical Characteristic Performance

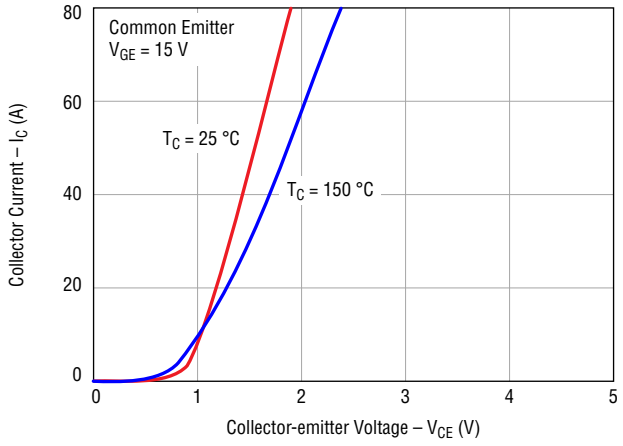
Typical Output Characteristics



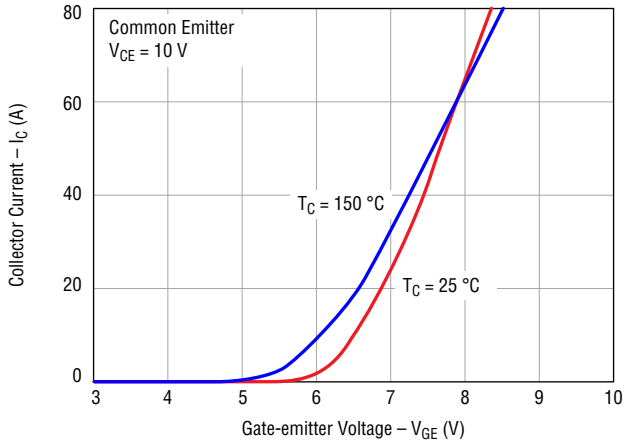
Typical Output Characteristics



Typical Saturation Voltage Characteristics



Typical Transfer Characteristics



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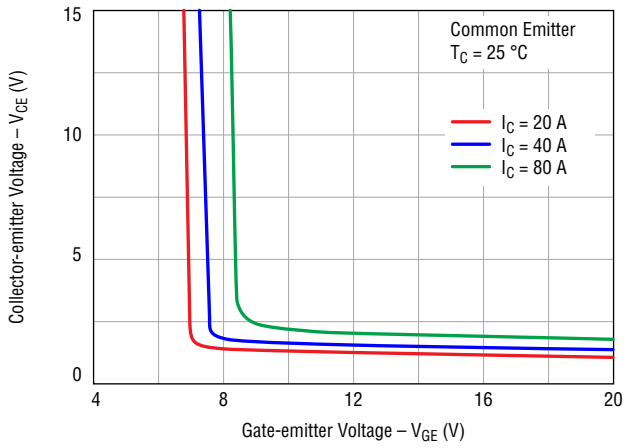
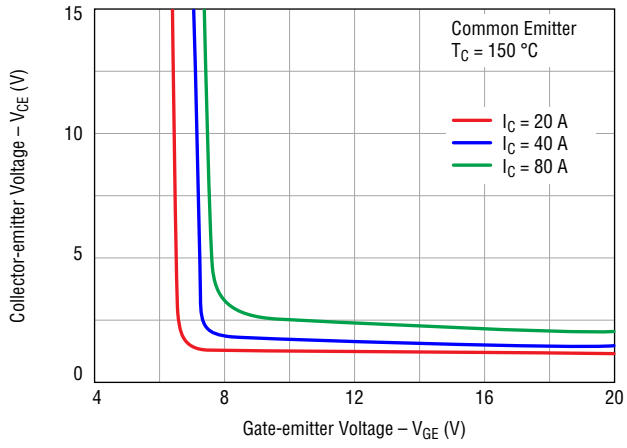
Electrical Characteristic Performance (continued)

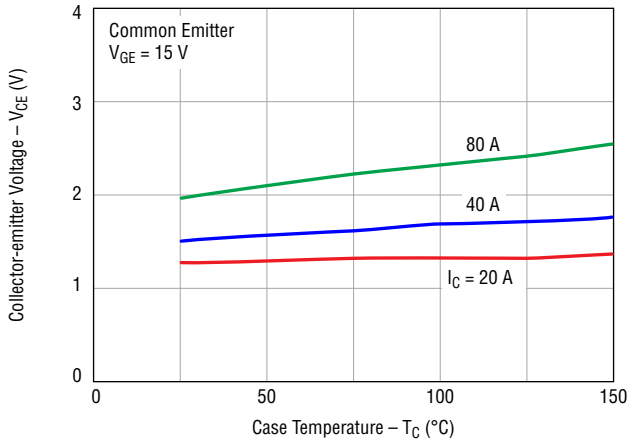
Typical Saturation Voltage Drop vs V_{GE} @ T_C = 25 °C



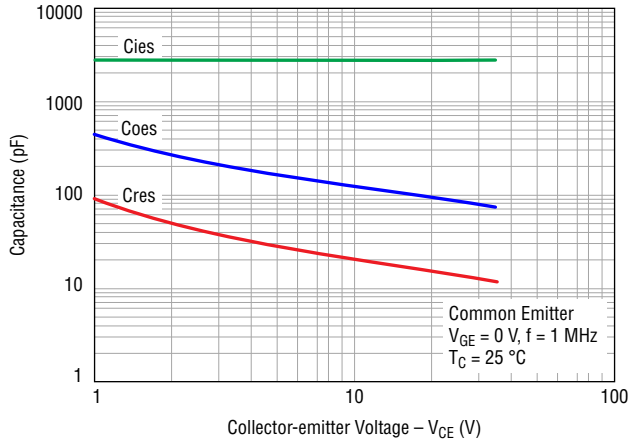
Typical Saturation Voltage Drop vs V_{GE} @ T_C = 150 °C



Typical Saturation Voltage Drop vs Temperature



Typical Capacitance Characteristics



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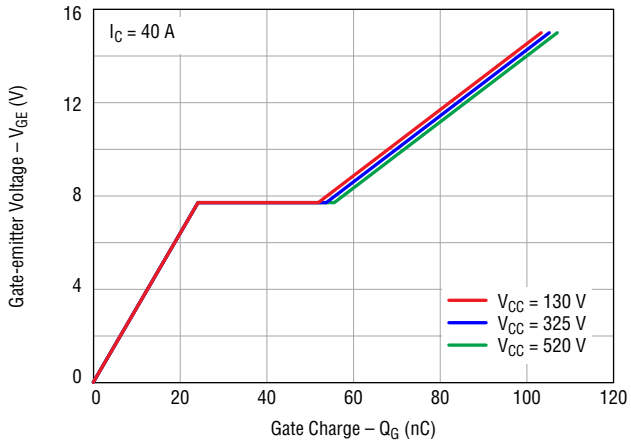
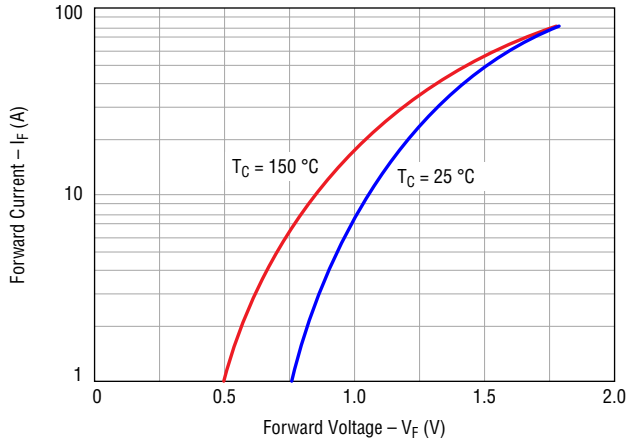
Electrical Characteristic Performance (continued)

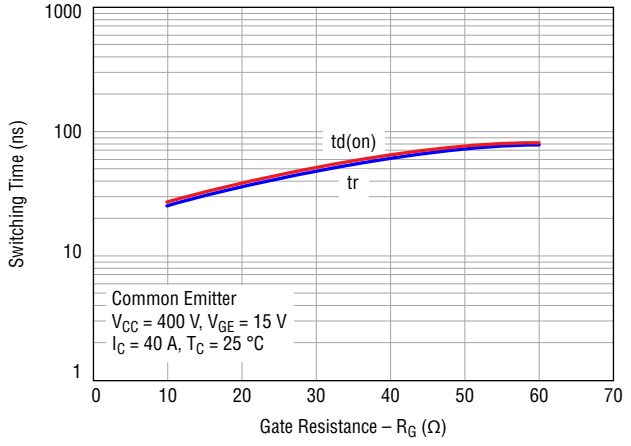
Typical Gate Charge Characteristics



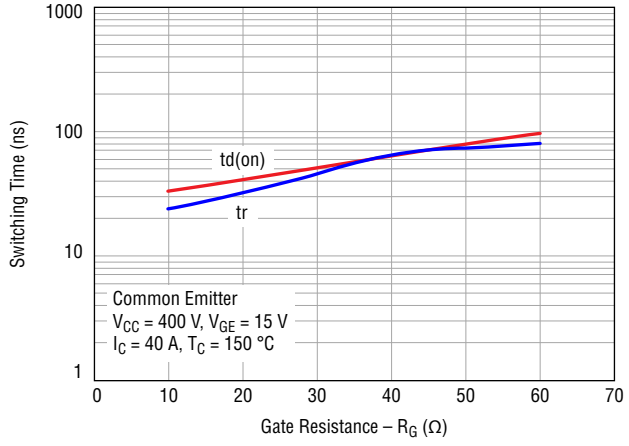
Typical Forward Characteristics



Typical Turn-on Characteristics vs Gate Resistance @ T_C = 25 °C



Typical Turn-on Characteristics vs Gate Resistance @ T_C = 150 °C



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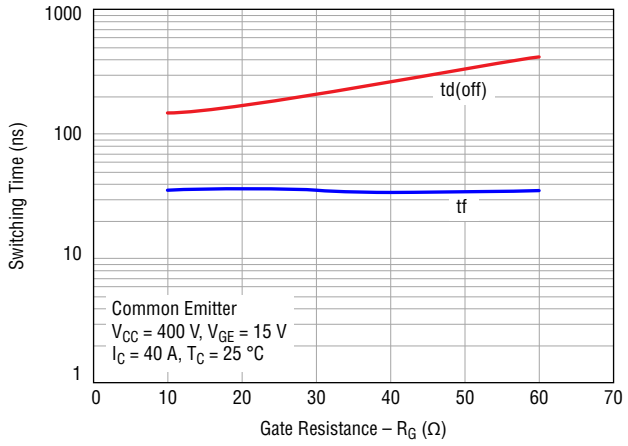
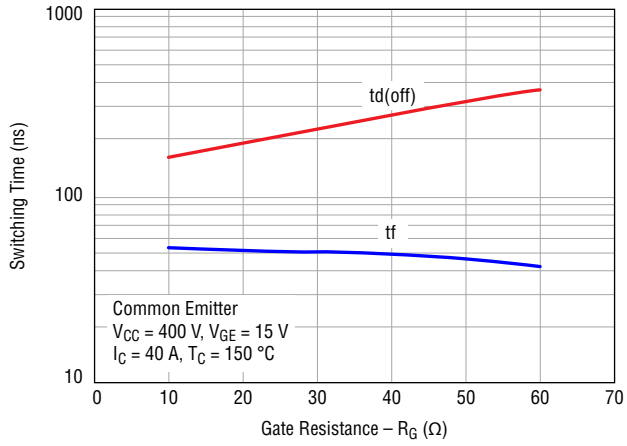
Electrical Characteristic Performance (continued)

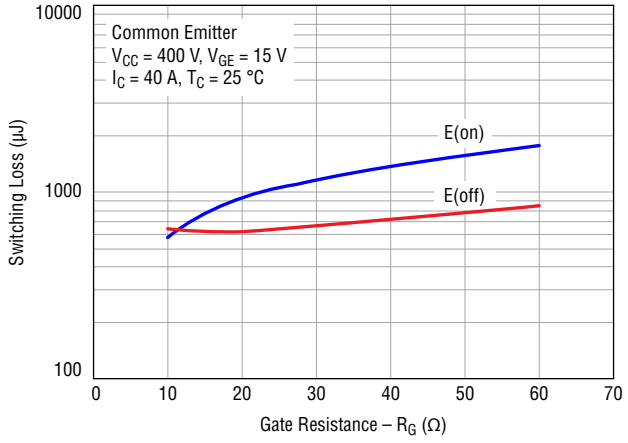
Typical Turn-off Characteristics vs Gate Resistance @ T_C = 25 °C



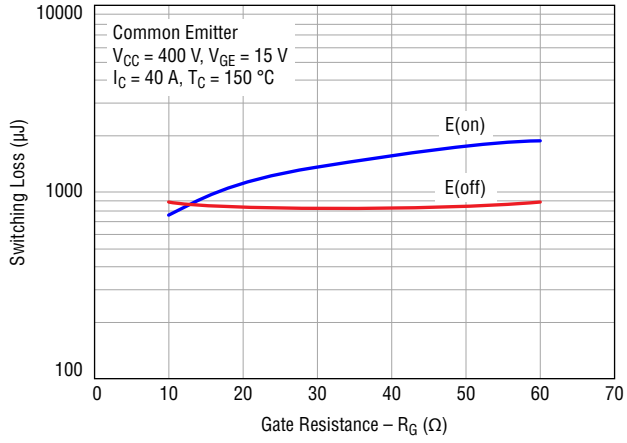
Typical Turn-off Characteristics vs Gate Resistance @ T_C = 150 °C



Typical Switching Loss vs Gate Resistance @ T_C = 25 °C



Typical Switching Loss vs Gate Resistance @ T_C = 150 °C



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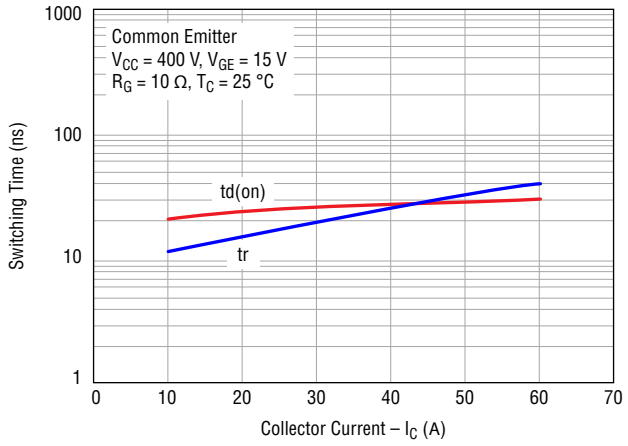
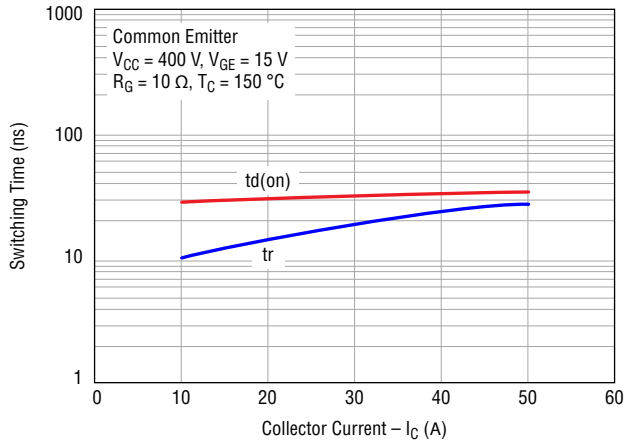
Electrical Characteristic Performance (continued)

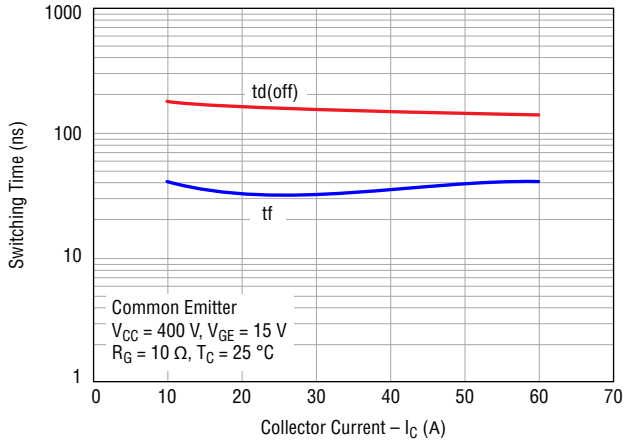
Typical Turn-on Characteristics vs Collector Current @ $T_C = 25\ °C$



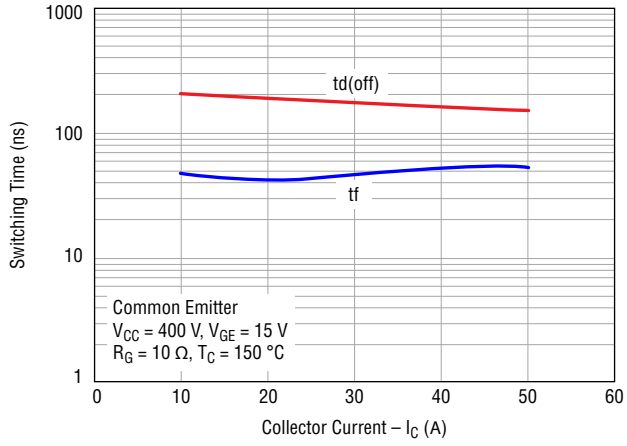
Typical Turn-on Characteristics vs Collector Current @ $T_C = 150\ °C$



Typical Turn-off Characteristics vs Collector Current @ $T_C = 25\ °C$



Typical Turn-off Characteristics vs Collector Current @ $T_C = 150\ °C$



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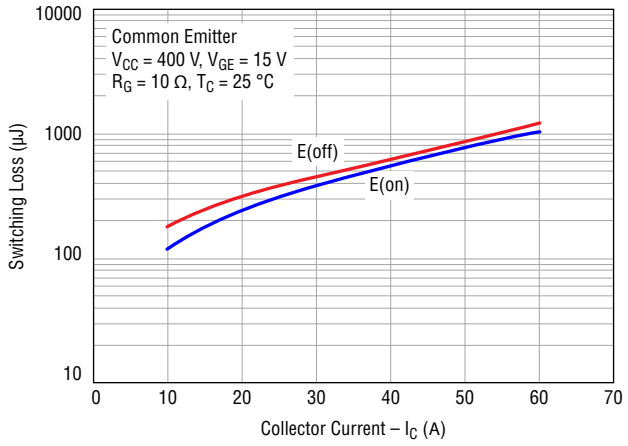
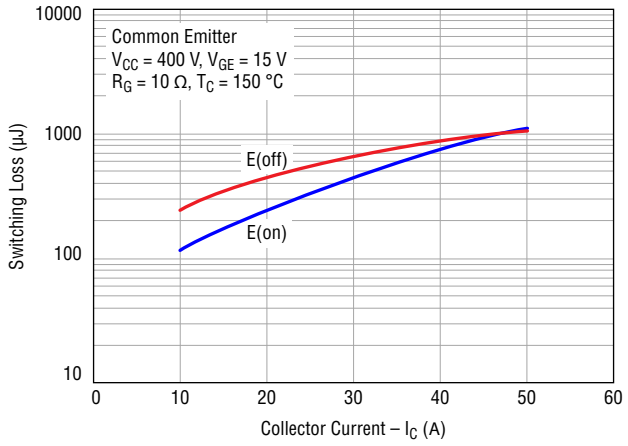
Electrical Characteristic Performance (continued)

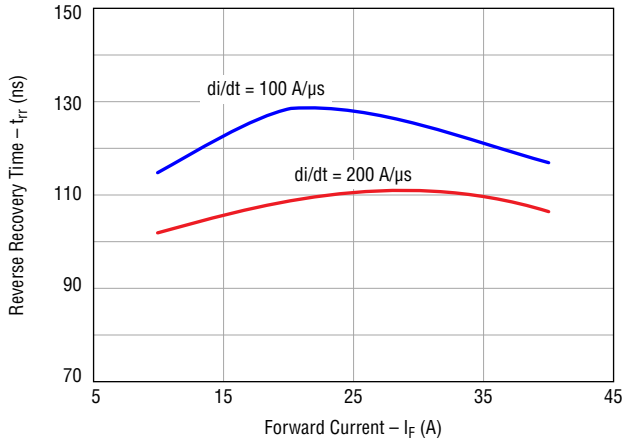
Typical Switching Loss vs Collector Current @ T_C = 25 °C



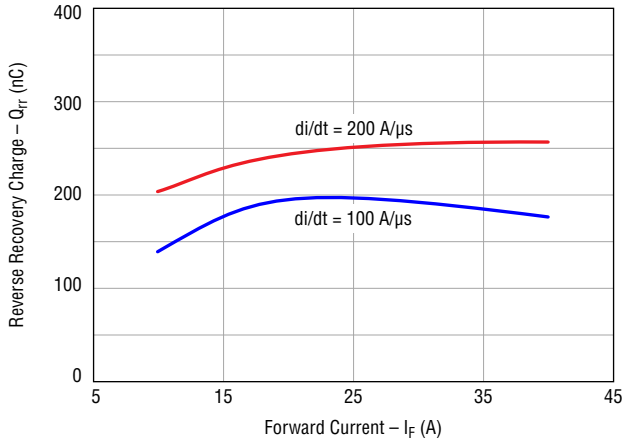
Typical Switching Loss vs Collector Current @ T_C = 150 °C



Typical Reverse Recovery Time vs Forward Current



Typical Reverse Recovery Charge vs Forward Current



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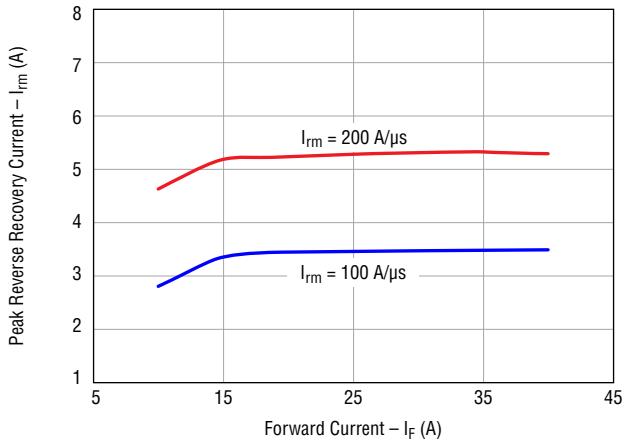
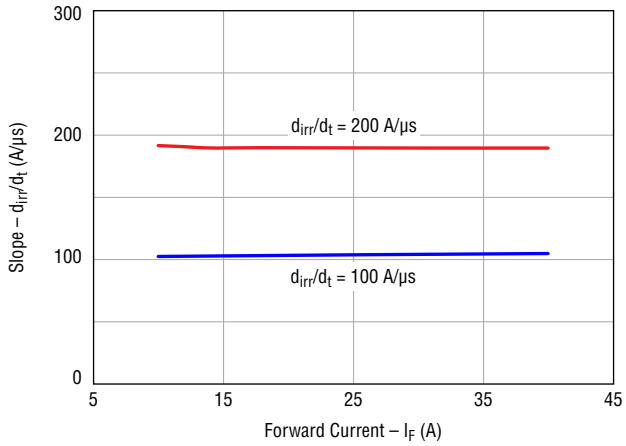
Electrical Characteristic Performance (continued)

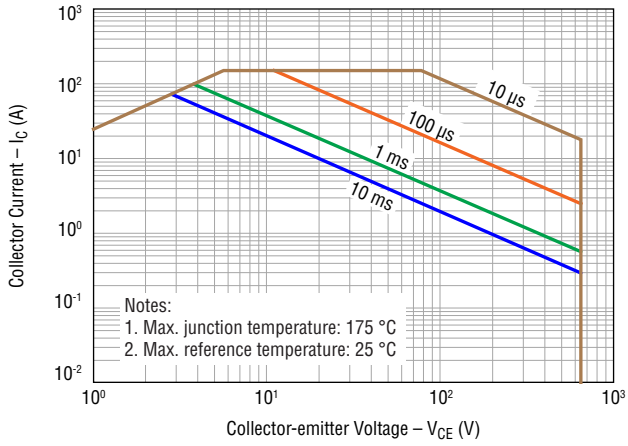
Typical Peak Reverse Recovery Current vs Forward Current



Typical Slope vs Forward Current



Maximum Safe Operating Area



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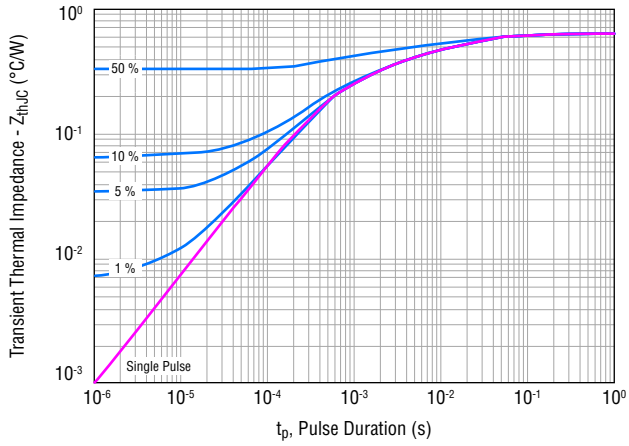
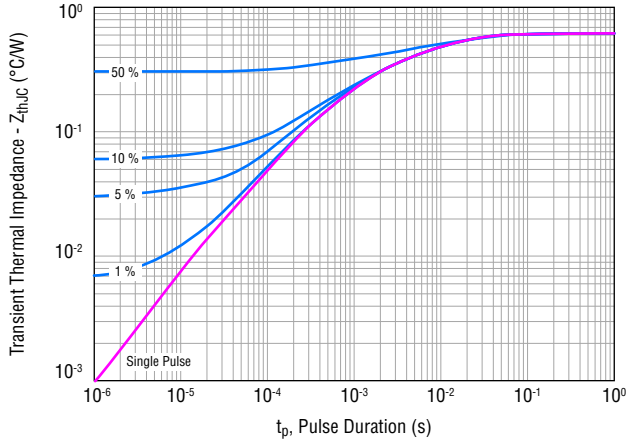
Electrical Characteristic Performance (continued)

IGBT Transient Thermal Impedance vs $t_{p(on)}$ Duration ($D=t_p/T$)



Diode Transient Thermal Impedance vs $t_{p(on)}$ Duration ($D=t_p/T$)



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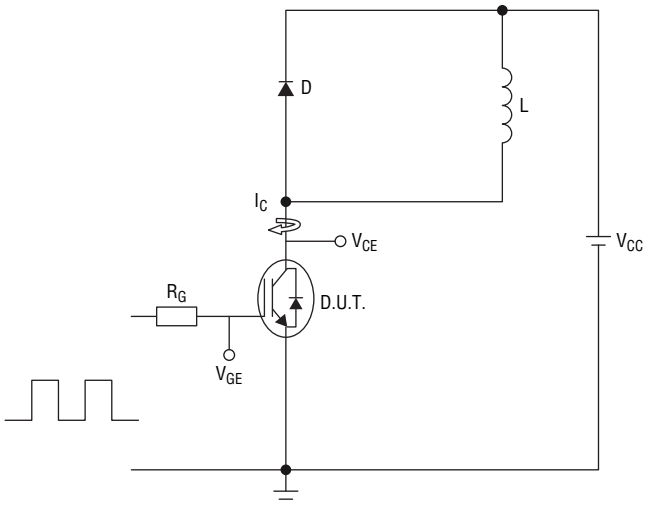
Inductive Load Test Circuit



L = 200 μH, V_{CE} = 400 V, V_{GE} = 15 V, I_C = 40 A, R_G = 10 Ω

How to Order

B I D W 40 N 65 ES5

- B = Bourns®
- I = IGBT
- Type
  - D = Discrete
- Package Code
  - W = TO-247-3L
- Current Rating
  - 40 = 40 A
- Device Type
  - N = N-channel
- Nominal Voltage (divided by 10)
  - 65 = 650 V
- Optimization
  - ES = Efficient Medium Speed
- Version Number
  - 5 = Revision Control

Environmental Characteristics

ESD Class (HBM).....2

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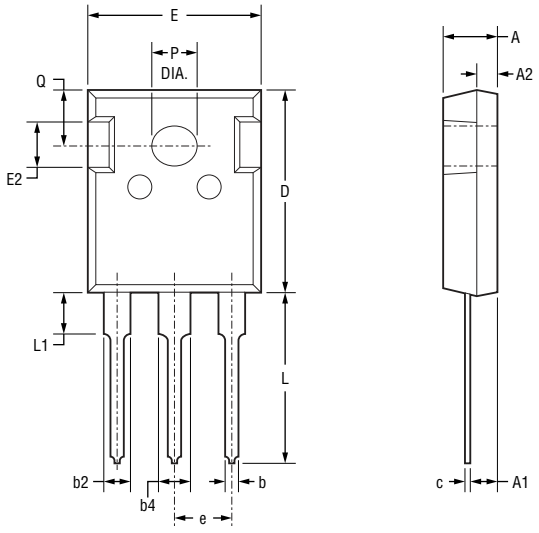
Product Dimensions



DIMENSIONS: MM (INCHES)

Symbol	Min.	Nom.	Max.
A	4.80 (.189)	5.00 (.197)	5.20 (.205)
A1	2.21 (.087)	2.41 (.095)	2.59 (.102)
A2	1.85 (.073)	2.00 (.079)	2.15 (.085)
b	1.11 (.044)	—	1.36 (.054)
b2	1.91 (.075)	—	2.25 (.089)
b4	2.91 (.115)	—	3.25 (.128)
c	0.51 (.020)	—	0.75 (.030)
D	20.80 (.819)	21.00 (.827)	21.30 (.839)
E	15.50 (.610)	15.80 (.622)	16.10 (.634)
E2	4.40 (.173)	5.00 (.197)	5.20 (.205)
e		5.44 (.214) BSC	
L	19.72 (.776)	19.92 (.784)	20.22 (.796)
L1	—	—	4.30 (.169)
P	3.40 (.134)	—	3.80 (.150)
Q	5.60 (.220)	5.80 (.228)	6.00 (.236)

Packaging Specifications

BIDW40N65ES5..... 30 pieces per tube

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REV. 11/23

Specifications are subject to change without notice.
Users should verify actual device performance in their specific applications.
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