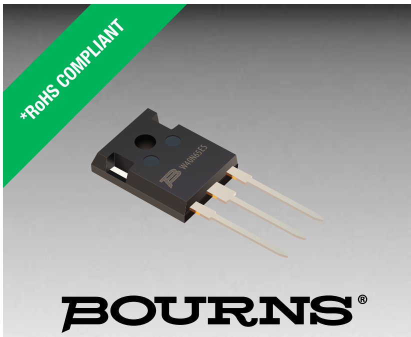


Features

- 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

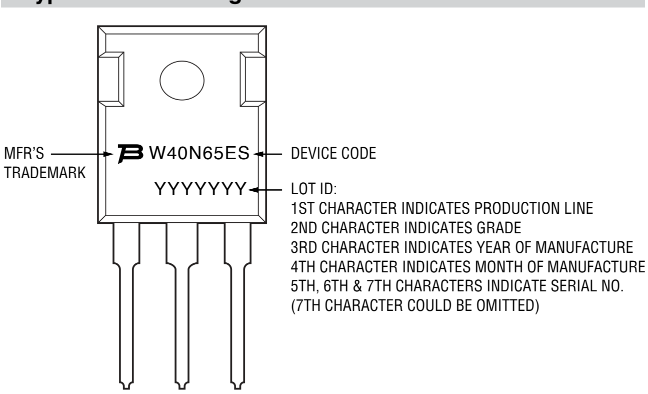
Maximum Electrical Ratings (T_C = 25 °C, unless otherwise specified)

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

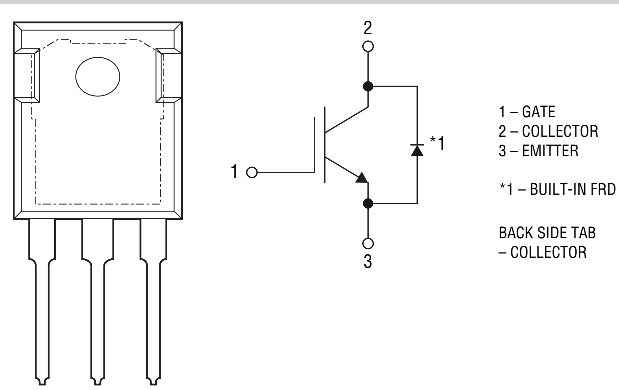
Thermal Resistance

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

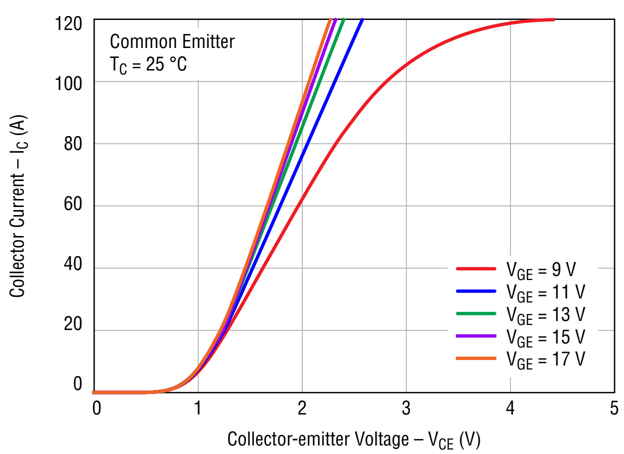
Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Turn-on Delay Time	$t_{d(on)}$	V_{CE} = 400 V, V_{GE} = 15 V, I_C = 40.0 A, R_G = 10 Ω	—	28	—	ns
Current Rise Time	t_r		—	26	—	ns
Turn-off Delay Time	$t_{d(off)}$		—	150	—	ns
Current Fall Time	t_f		—	36	—	ns
Turn-on Switching Energy	E_{on}	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

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

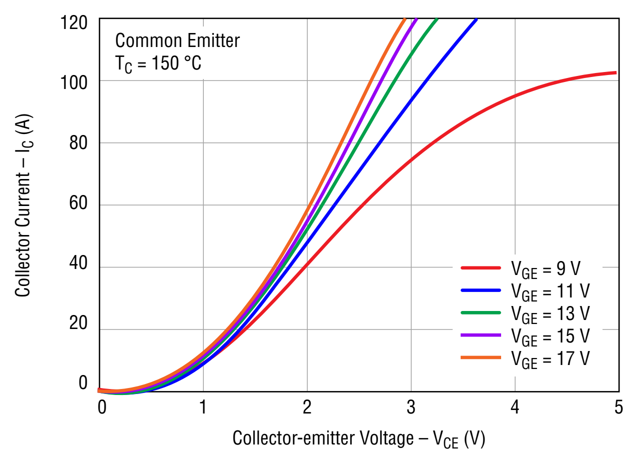
Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Reverse Recovery Time	t_{rr}	dI_F/dt = 200 A/μs, I_F = 40 A	—	106	—	ns
Reverse Recovery Charge	Q_{rr}		—	258	—	nC

Electrical Characteristic Performance

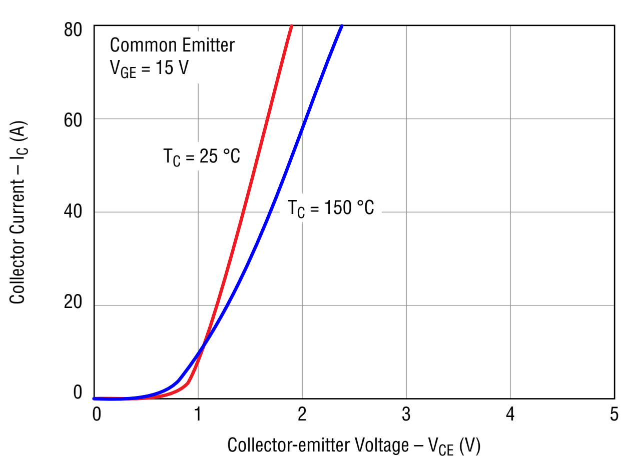
Typical Output Characteristics



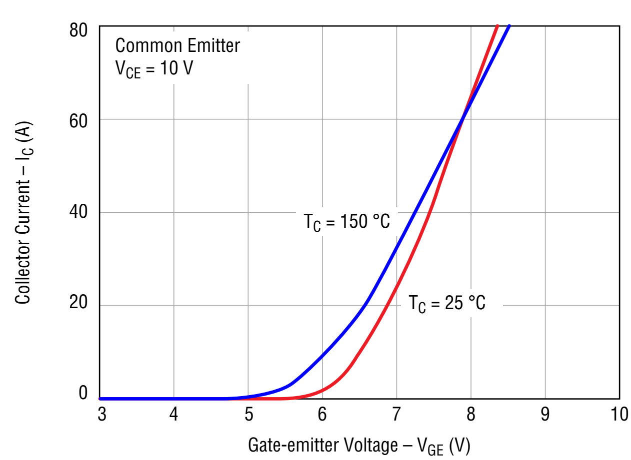
Typical Output Characteristics



Typical Saturation Voltage Characteristics

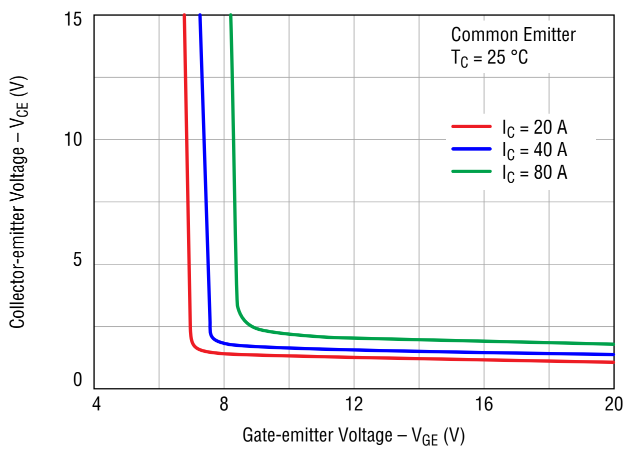


Typical Transfer Characteristics

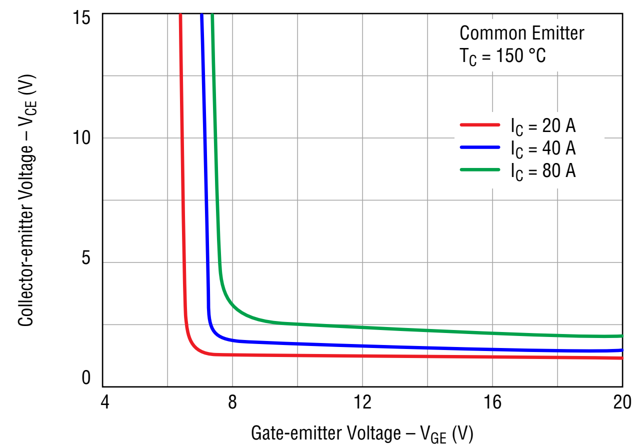


Electrical Characteristic Performance (continued)

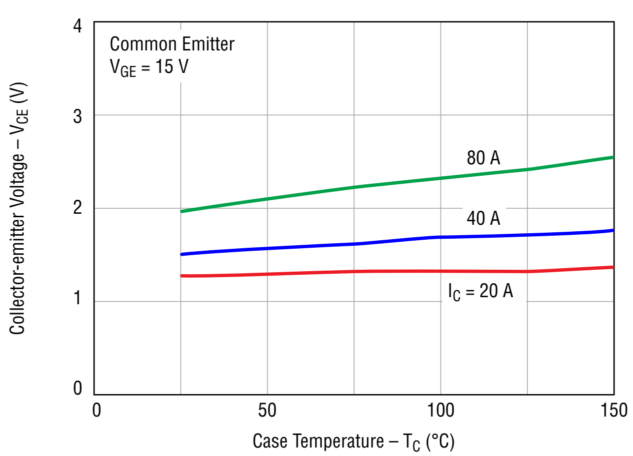
Typical Saturation Voltage Drop vs V_{GE} @ T_C = 25 °C



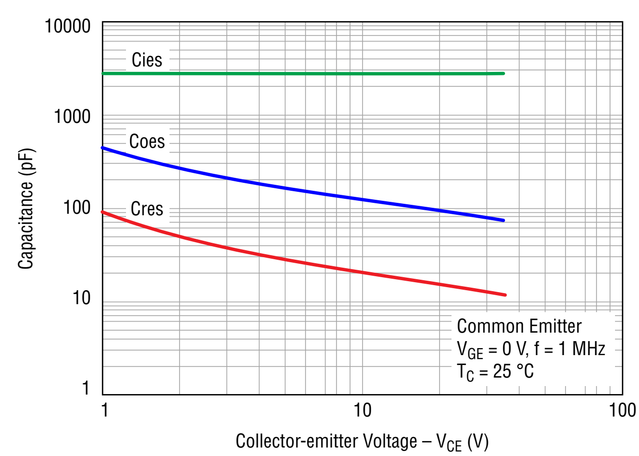
Typical Saturation Voltage Drop vs V_{GE} @ T_C = 150 °C



Typical Saturation Voltage Drop vs Temperature

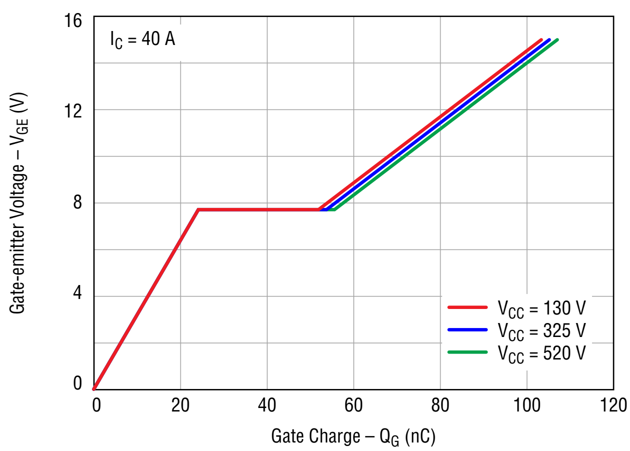


Typical Capacitance Characteristics

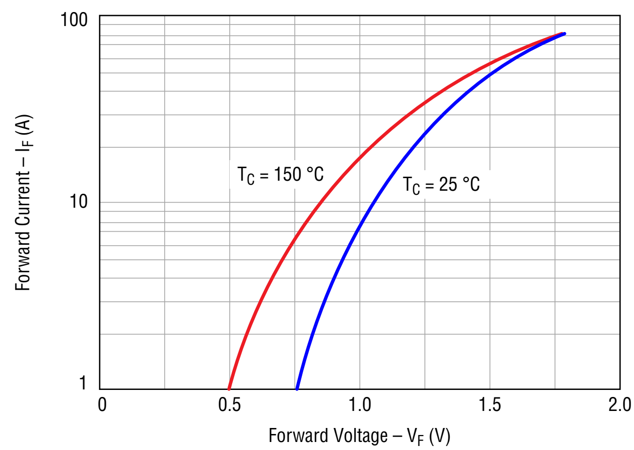


Electrical Characteristic Performance (continued)

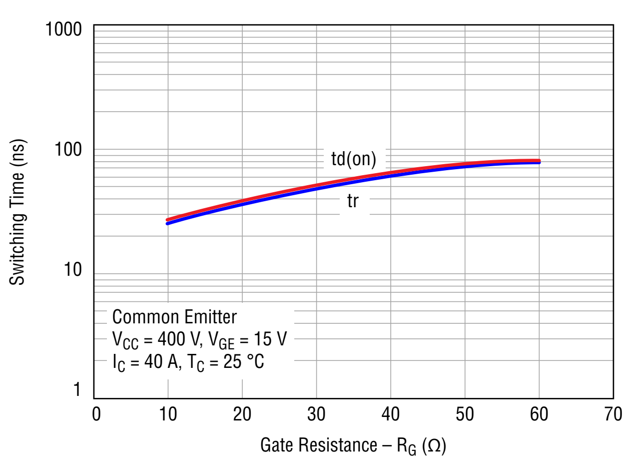
Typical Gate Charge Characteristics



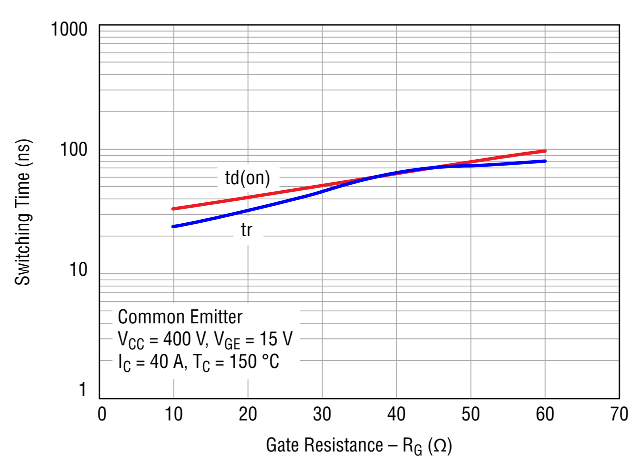
Typical Forward Characteristics



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

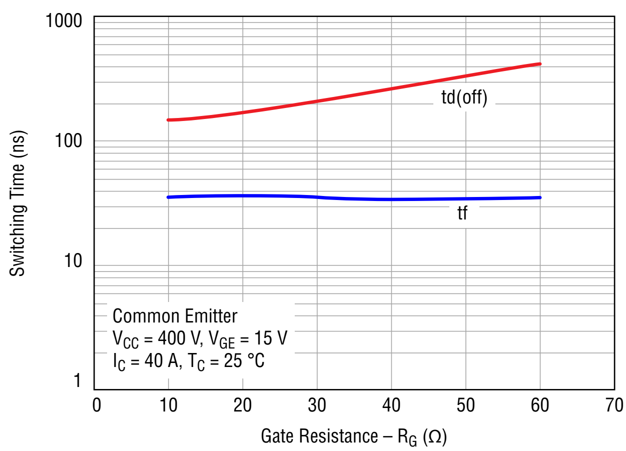


Typical Turn-on Characteristics vs Gate Resistance @ T_C = 150 °C

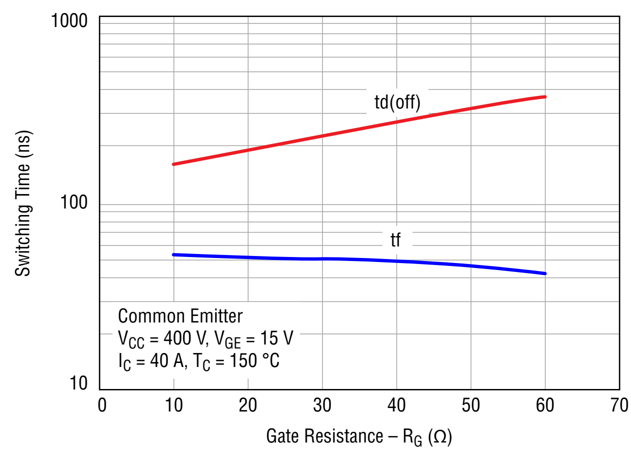


Electrical Characteristic Performance (continued)

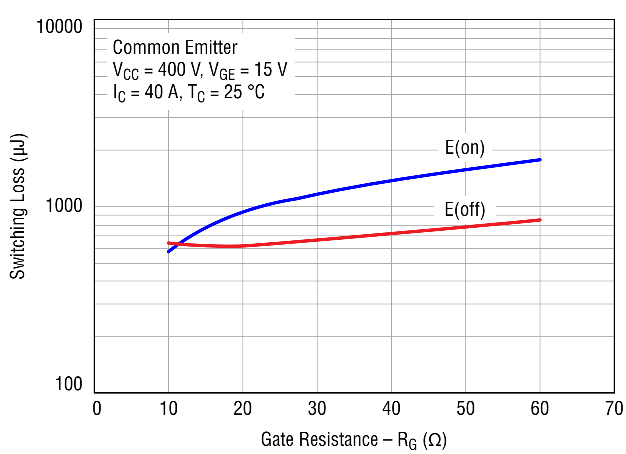
Typical Turn-off Characteristics vs Gate Resistance @ T_C = 25 °C



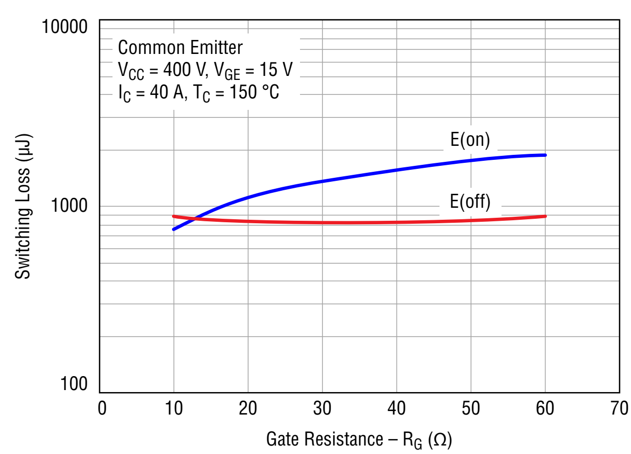
Typical Turn-off Characteristics vs Gate Resistance @ T_C = 150 °C



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

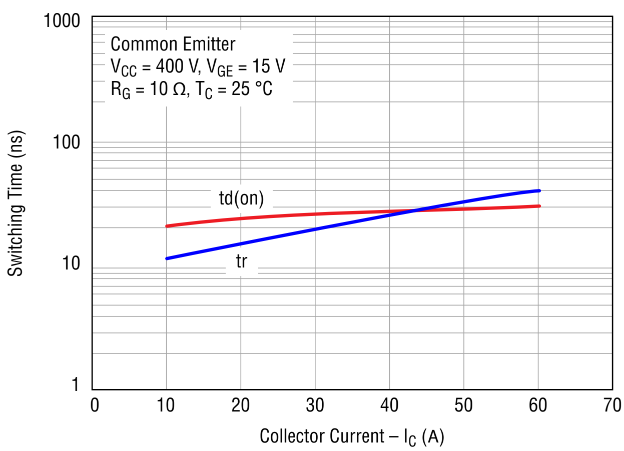


Typical Switching Loss vs Gate Resistance @ T_C = 150 °C

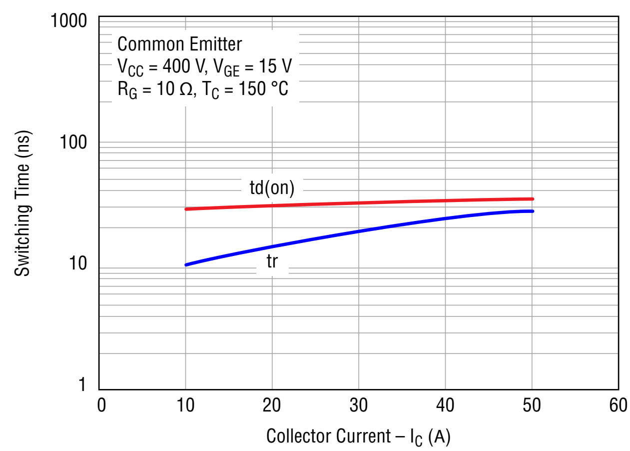


Electrical Characteristic Performance (continued)

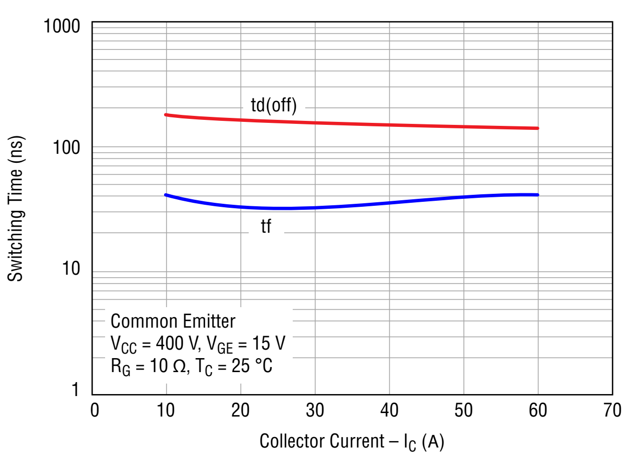
Typical Turn-on Characteristics vs Collector Current @ T_C = 25 °C



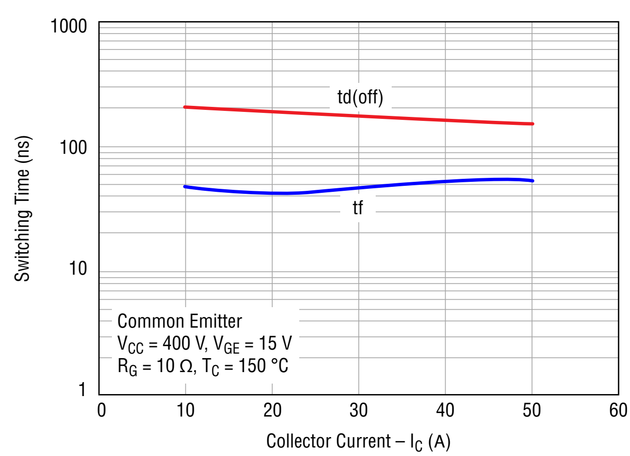
Typical Turn-on Characteristics vs Collector Current @ T_C = 150 °C



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

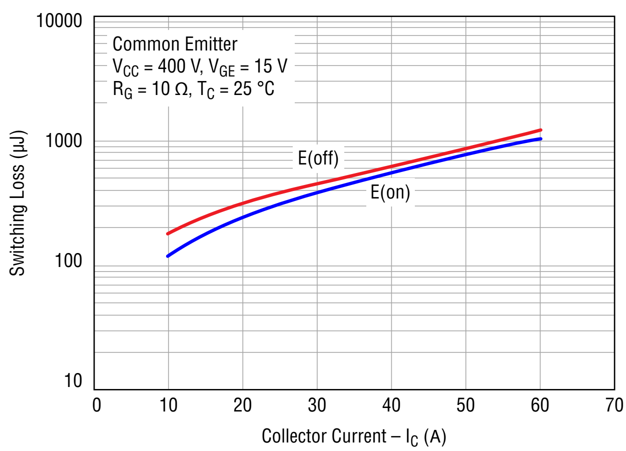


Typical Turn-off Characteristics vs Collector Current @ T_C = 150 °C

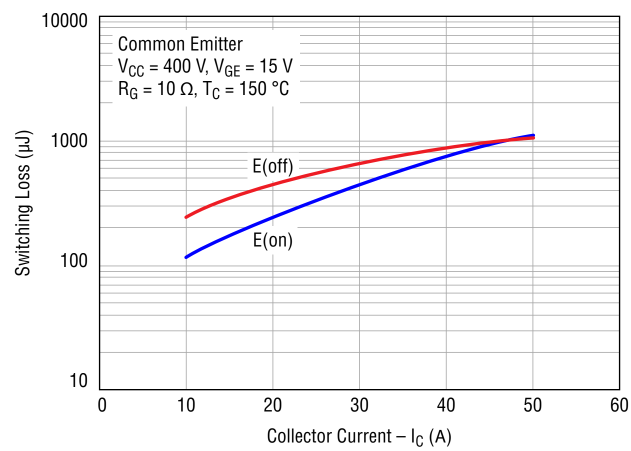


Electrical Characteristic Performance (continued)

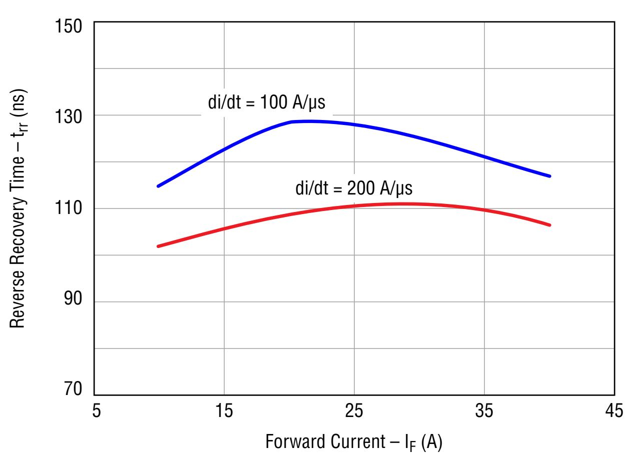
Typical Switching Loss vs Collector Current @ T_C = 25 °C



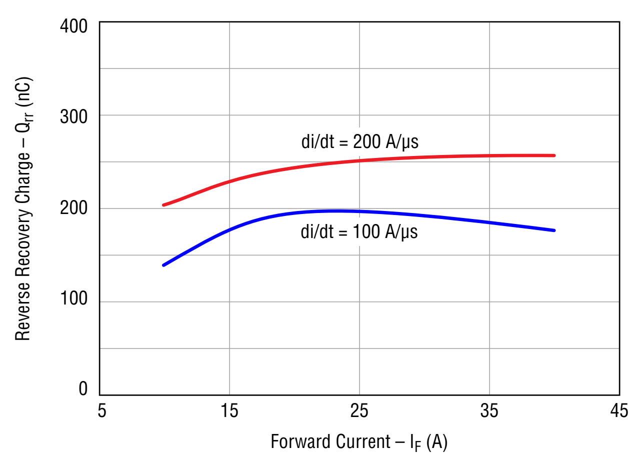
Typical Switching Loss vs Collector Current @ T_C = 150 °C



Typical Reverse Recovery Time vs Forward Current

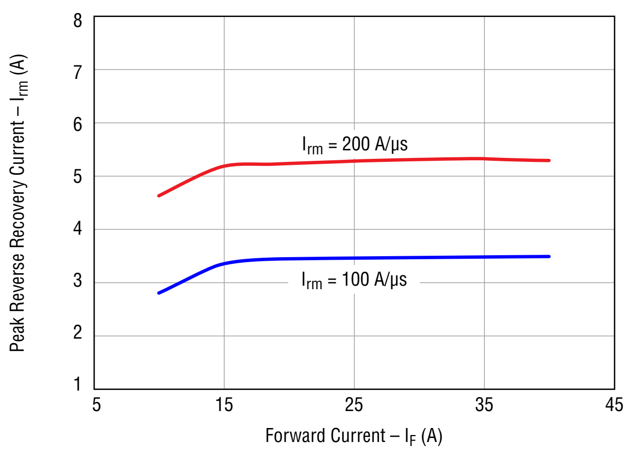


Typical Reverse Recovery Charge vs Forward Current

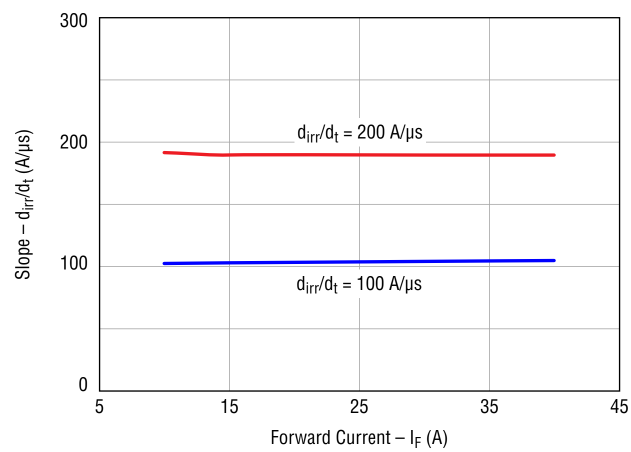


Electrical Characteristic Performance (continued)

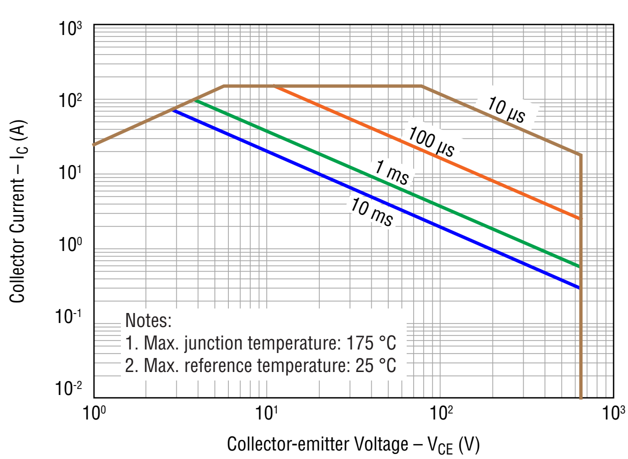
Typical Peak Reverse Recovery Current vs Forward Current



Typical Slope vs Forward Current

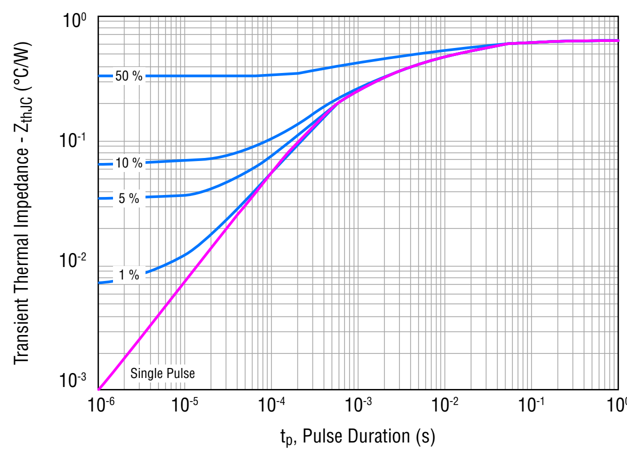


Maximum Safe Operating Area

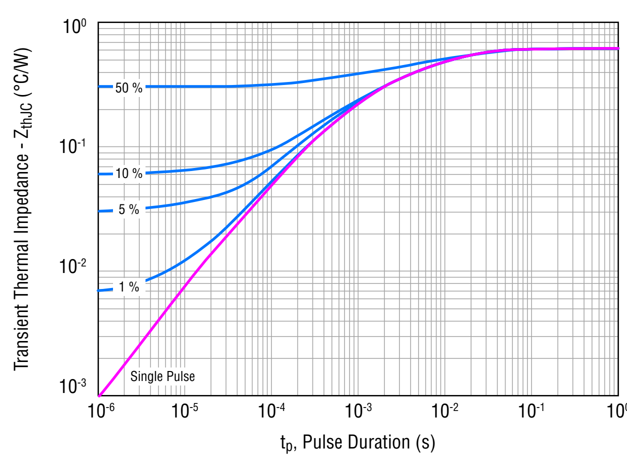


Electrical Characteristic Performance (continued)

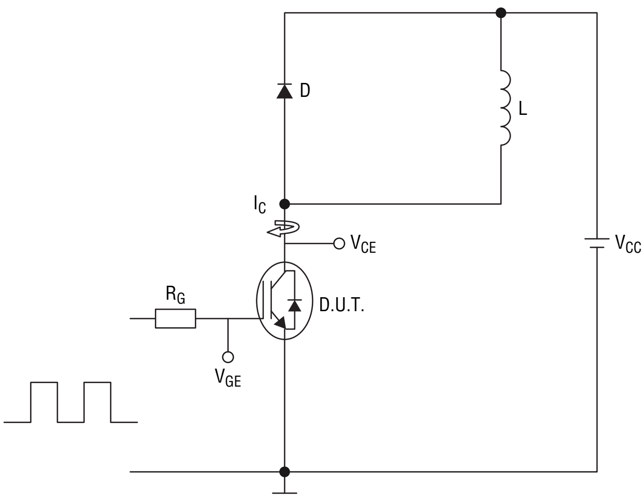
IGBT Transient Thermal Impedance vs $t_{p(on)}$ Duration ($D=t_p/T$)



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



Inductive Load Test Circuit



$L = 200\ \mu H$, $V_{CE} = 400\ V$, $V_{GE} = 15\ V$, $I_C = 40\ A$, $R_G = 10\ \Omega$

How to Order

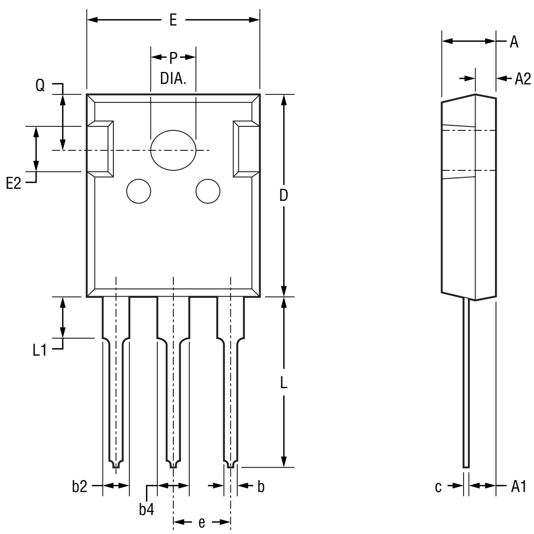
B I D W 40 N 65 ES5

- 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

Product Dimensions



DIMENSIONS: $\frac{\text{MM}}{\text{(INCHES)}}$

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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Email: asiacus@bourns.com

EMEA: Tel: +36 88 885 877
Email: eurocus@bourns.com

The Americas: Tel: +1-951 781-5500
Email: americus@bourns.com

www.bourns.com

REV. 11/23

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