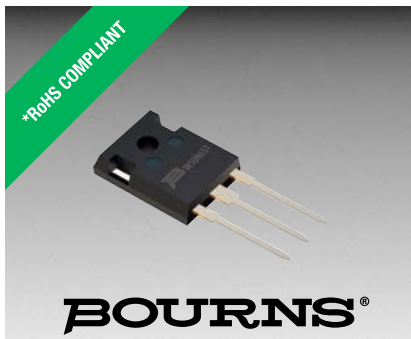




Features

- 650 V, 50 A, Low Collector-Emitter Saturation Voltage ($V_{CE(sat)}$)
- Novel trench-gate field-stop technology
- Optimized for conduction
- RoHS compliant*

Applications

- Switch-Mode Power Supplies (SMPS)
- Uninterruptible Power Sources (UPS)
- Power Factor Correction (PFC)
- Inverters

BIDW50N65T Insulated Gate Bipolar Transistor (IGBT)

General Information

The Bourns® Model BIDW50N65T 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. In addition, this structure provides a lower thermal resistance R_{th} .

Additional Information

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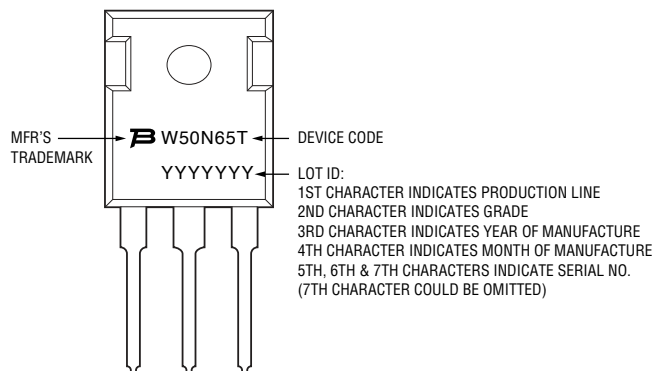
Maximum Electrical Ratings ($T_C = 25^\circ\text{C}$, unless otherwise specified)

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CES}	650	V
Continuous Collector Current ($T_C = 25^\circ\text{C}$), limited by T_{jmax}	I_C	100	A
Continuous Collector Current ($T_C = 100^\circ\text{C}$), limited by T_{jmax}	I_C	50	A
Pulsed Collector Current, t_p limited by T_{jmax}	I_{CP}	150	A
Gate-Emitter Voltage	V_{GE}	± 20	V
Continuous Forward Current ($T_C = 100^\circ\text{C}$), limited by T_{jmax}	I_F	50	A
Short-circuit Withstand Time ($V_{CE} = 300\text{ V}$, $V_{GE} = 15\text{ V}$)	T_{SC}	10	μs
Total Power Dissipation	P_{total}	416	W
Storage Temperature	T_{STG}	-55 to +150	$^\circ\text{C}$
Operating Junction Temperature	T_j	-55 to +150	$^\circ\text{C}$

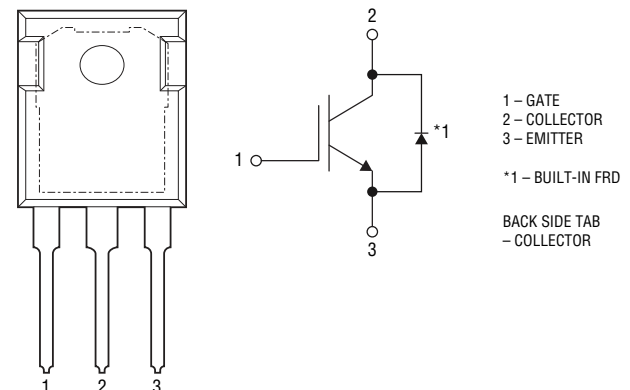
Thermal Resistance

Parameter	Symbol	Max	Unit
IGBT Thermal Resistance Junction - Case	$R_{th(j-c)}_{IGBT}$	0.3	$^\circ\text{C/W}$
Diode Thermal Resistance Junction - Case	$R_{th(j-c)}_{Diode}$	0.65	$^\circ\text{C/W}$

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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BIDW50N65T Insulated Gate Bipolar Transistor (IGBT)

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Static Electrical Characteristics ($T_C = 25^\circ\text{C}$, Unless Otherwise Specified)

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Collector-Emitter Breakdown Voltage	BV_{CES}	$V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$	650	—	—	V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE} = 15\text{ V}, I_C = 50\text{ A}$ $T_C = 25^\circ\text{C}$	—	1.65	2.2	V
		$V_{GE} = 15\text{ V}, I_C = 50\text{ A}$ $T_C = 125^\circ\text{C}$	—	1.9	—	
Diode Forward On-Voltage	V_F	$I_F = 50\text{ A}, T_C = 25^\circ\text{C}$	—	1.7	2.5	V
		$I_F = 50\text{ A}, T_C = 125^\circ\text{C}$	—	1.3	—	V
Gate Threshold Voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C = 250\text{ }\mu\text{A}$	4.0	5.0	7.0	V
Collector Cut-off Current	I_{CES}	$V_{GE} = 0\text{ V}, V_{CE} = 650\text{ V}$	—	—	200	μA
Gate-Emitter Leakage Current	I_{GES}	$V_{CE} = 0\text{ V}, V_{GE} = \pm 20\text{ V}$	—	—	± 400	nA

Dynamic Electrical Characteristics ($T_C = 25^\circ\text{C}$, Unless Otherwise Specified)

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Input Capacitance	C_{ies}	$V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V},$ $f = 1\text{ MHz}$	—	2723	—	pF
Output Capacitance	C_{oes}		—	230	—	
Reverse Transfer Capacitance	C_{res}		—	55	—	
Total Gate Charge	Q_g	$V_{CE} = 400\text{ V}, V_{GE} = 15\text{ V}$ $I_C = 50.0\text{ A}$	—	123	—	nC
Gate-Emitter Charge	Q_{ge}		—	31	—	
Gate-Collector Charge	Q_{gc}		—	48	—	

IGBT Switching Characteristics (Inductive Load, $T_C = 25^\circ\text{C}$, unless otherwise specified)

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Turn-on Delay Time	$t_{d(on)}$	$V_{CE} = 400\text{ V}, V_{GE} = 15\text{ V}$ $I_C = 50.0\text{ A}, R_G = 10\text{ }\Omega$	—	37	—	ns
Current Rise Time	t_r		—	133	—	ns
Turn-off Delay Time	$t_{d(off)}$		—	125	—	ns
Current Fall Time	t_f		—	121	—	ns
Turn-on Switching Energy	E_{on}		—	3.0	—	mJ
Turn-off Switching Energy	E_{off}		—	1.1	—	mJ
Total Switching Energy	E_{ts}		—	4.1	—	mJ

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BIDW50N65T Insulated Gate Bipolar Transistor (IGBT)

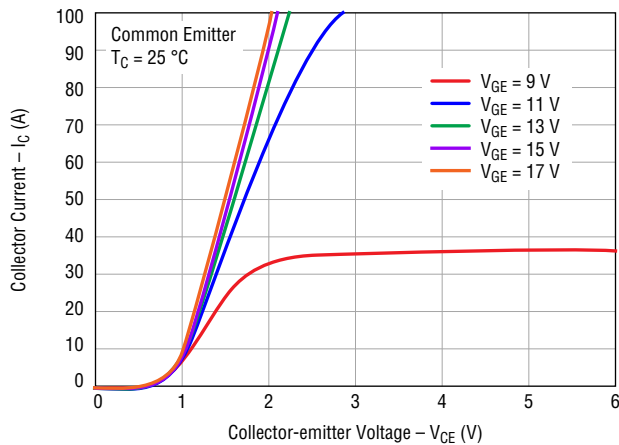
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Diode Switching Characteristics ($T_C = 25^\circ\text{C}$, unless otherwise specified)

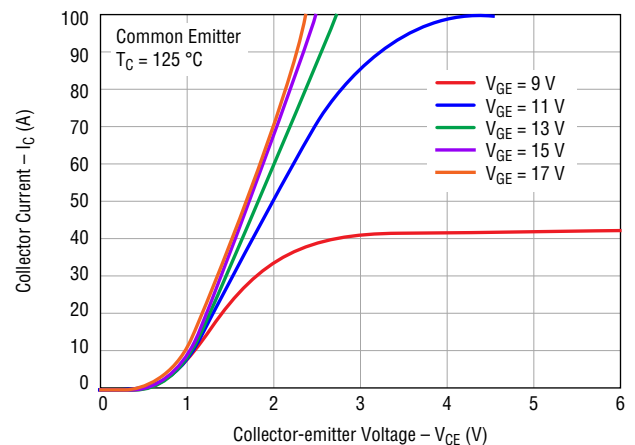
Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Reverse Recovery Time	t_{rr}	$dI_F/dt = 200 \text{ A}/\mu\text{s}$ $I_F = 50.0 \text{ A}$	—	37.5	—	ns
Reverse Recovery Charge	Q_{rr}		—	78	—	nC

Electrical Characteristic Performance

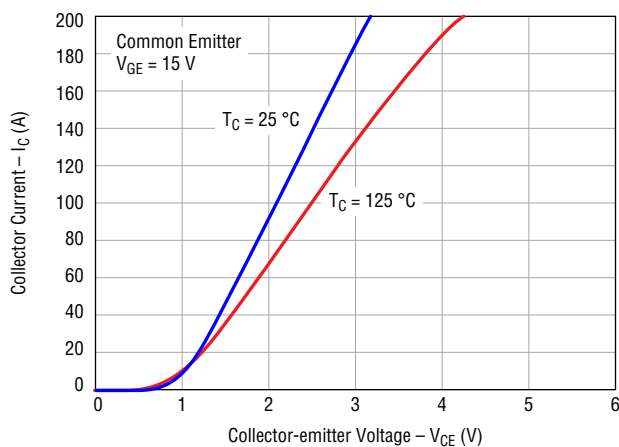
Typical Output Characteristics



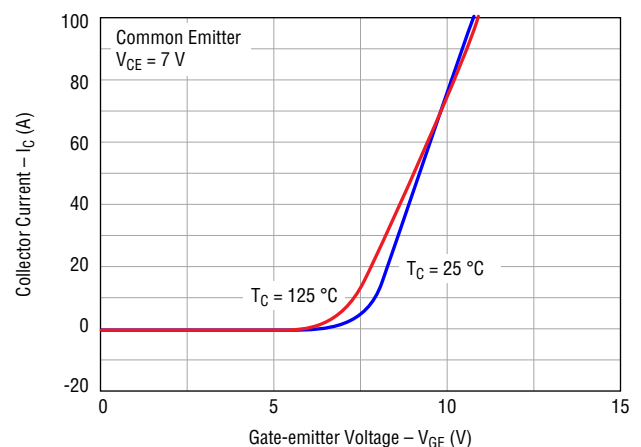
Typical Output Characteristics



Typical Saturation Voltage Characteristics



Typical Transfer Characteristics



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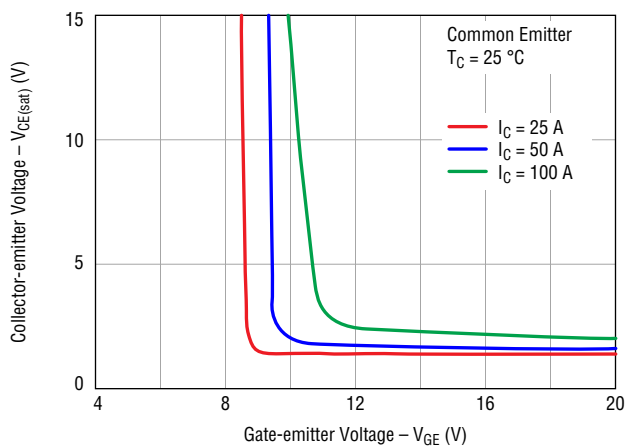
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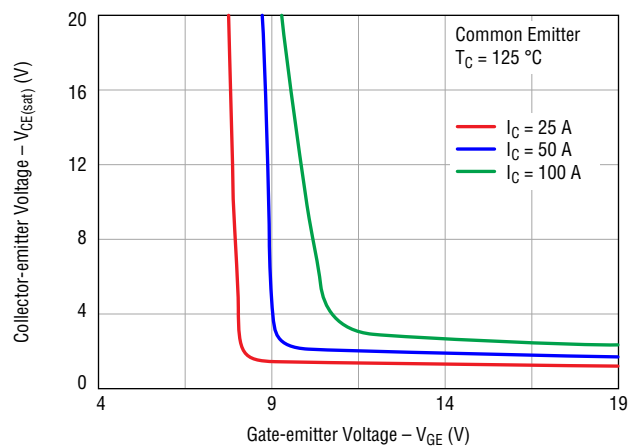
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Electrical Characteristic Performance (continued)

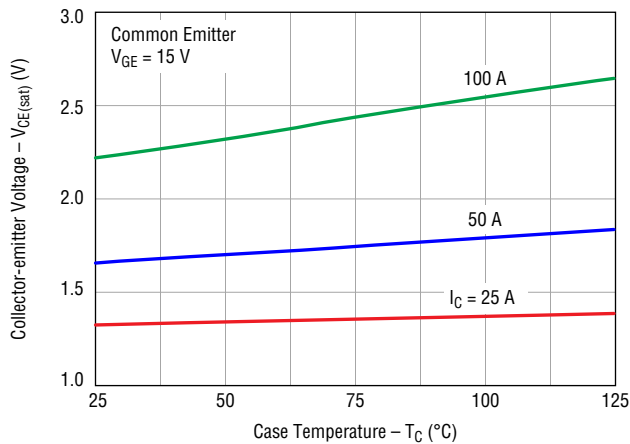
Typical $V_{CE(sat)}$ vs V_{GE} @ $T_C = 25^\circ\text{C}$



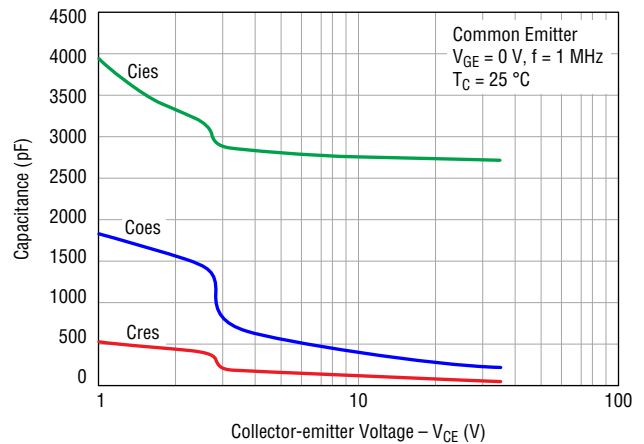
Typical $V_{CE(sat)}$ vs V_{GE} @ $T_C = 125^\circ\text{C}$



Typical $V_{CE(sat)}$ vs Case Temperature



Typical Capacitance Characteristics



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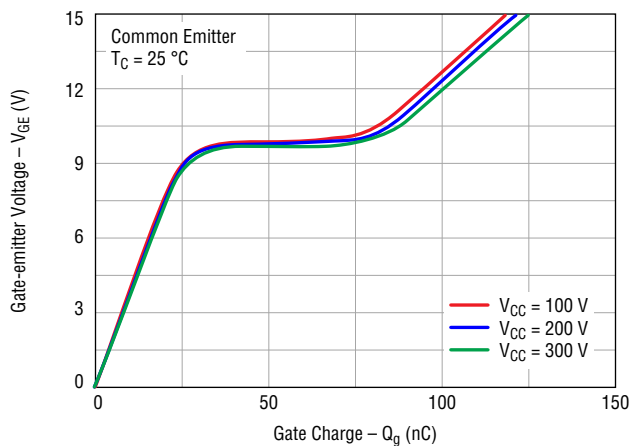
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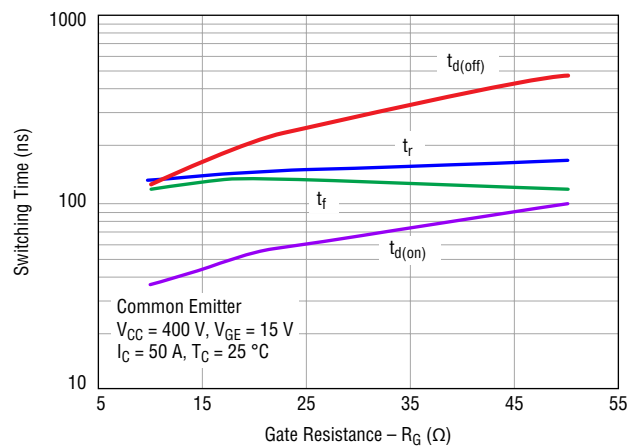
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Electrical Characteristic Performance (continued)

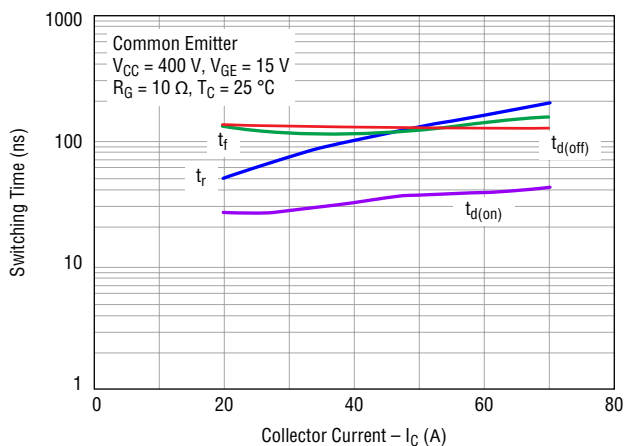
Typical Gate Charge Characteristics



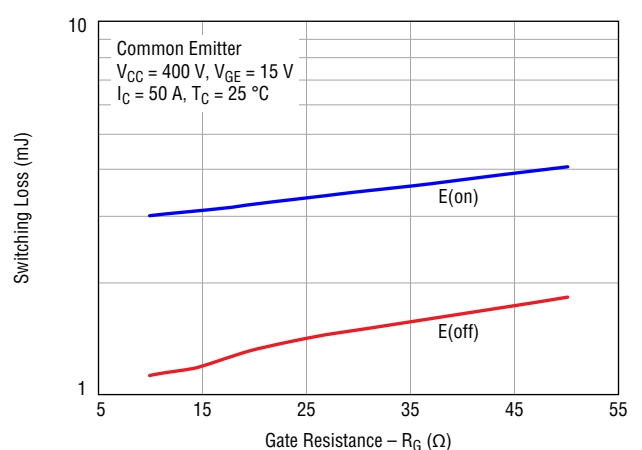
Typical Switching Time Characteristics vs R_G



Typical Switching Time Characteristics vs I_C



Typical Switching Loss vs R_G



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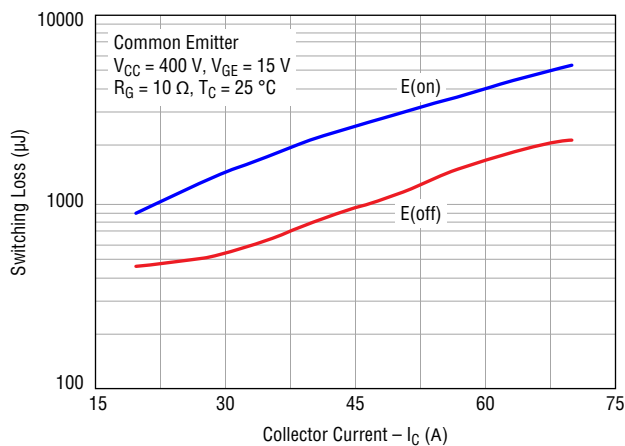
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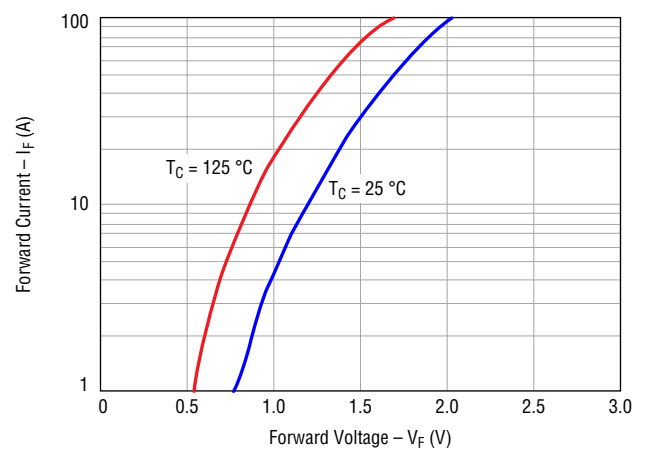
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Electrical Characteristic Performance (continued)

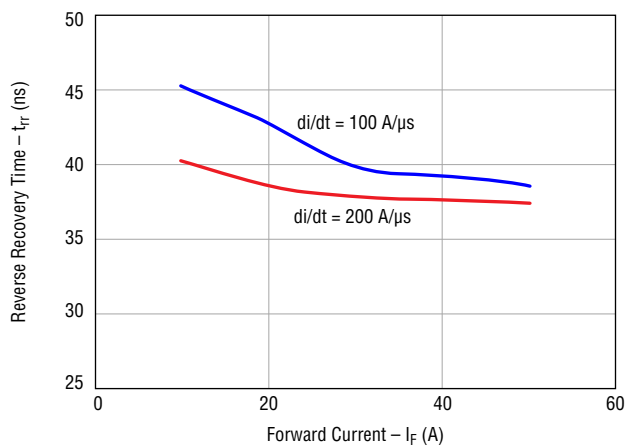
Typical Switching Loss Characteristics vs I_C



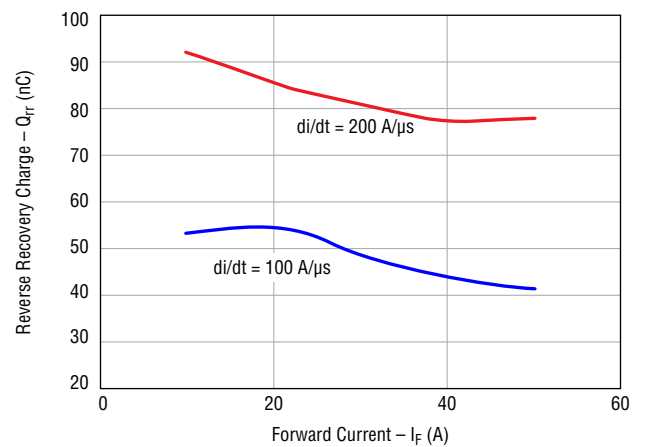
Typical Diode I_F vs V_F



Typical Reverse Recovery Time vs I_F



Typical Reverse Recovery Charge vs I_F



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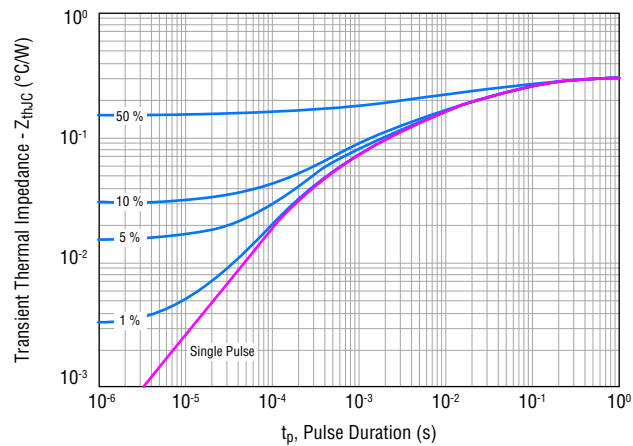
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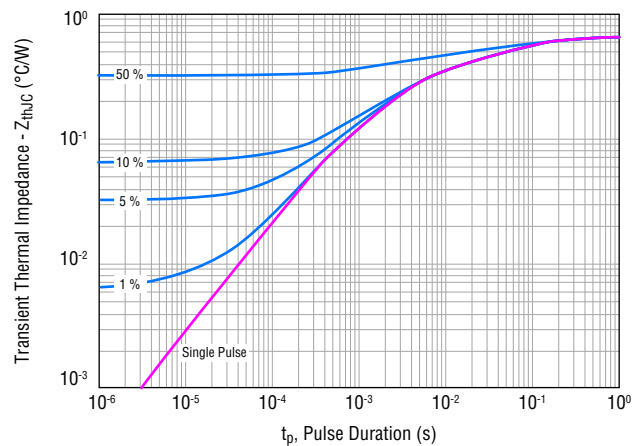
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Electrical Characteristic Performance (continued)

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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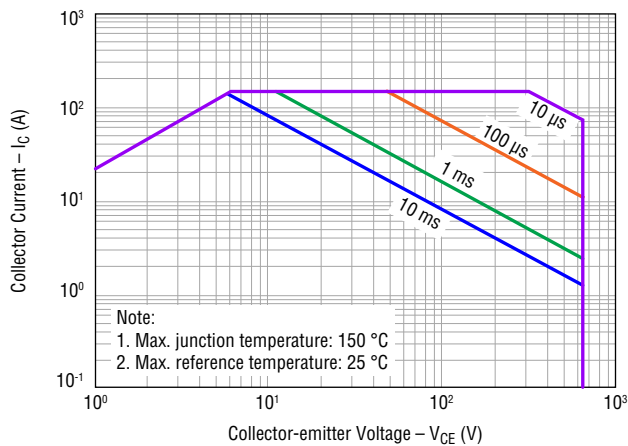
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Electrical Characteristic Performance (continued)

Forward Bias Safe Operating Area

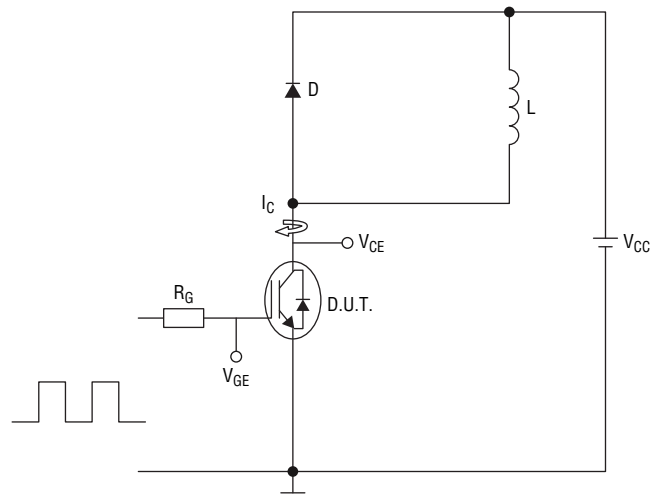


How to Order

B I D W 50 N 65 T

B = Bourns®
 I = IGBT
 Type
 D = Discrete
 Package Code
 W = TO-247-3L
 Current Rating
 50 = 50 A
 Device Type
 N = N-channel
 Nominal Voltage (divided by 10)
 65 = 650 V
 Optimization
 T = Medium Speed

Inductive Load Test Circuit



$L = 1.12 \text{ mH}$, $V_{CE} = 400 \text{ V}$, $V_{GE} = 15 \text{ V}$, $I_C = 50 \text{ A}$, $R_G = 10 \Omega$

Environmental Characteristics

ESD Class (HBM)2

Specifications are subject to change without notice.

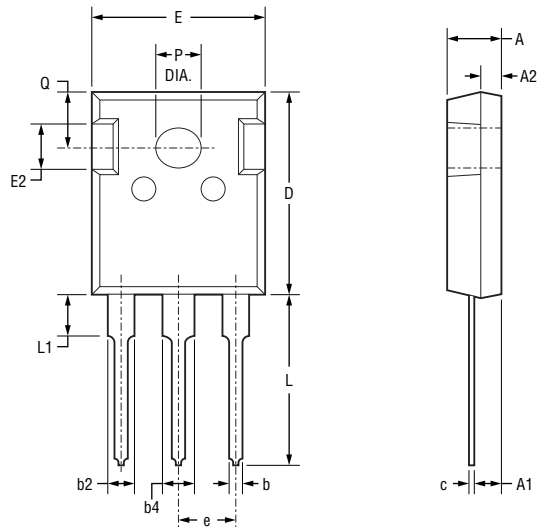
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BIDW50N65T Insulated Gate Bipolar Transistor (IGBT)

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Product Dimensions



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

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

Packaging Specifications

BIDW50N65T 30 pieces per tube

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www.bourns.com

REV. 04/23

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