

## Features

- 650 V, 75 A, Low Collector-Emitter Saturation Voltage ( $V_{CE(sat)}$ )
- Novel trench-gate field-stop technology
- Optimized for conduction
- Medium speed switching
- Maximum operating  $T_j = 175\text{ }^\circ\text{C}$
- RoHS compliant\*

## Applications

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

# BIDW75N65ES5 Insulated Gate Bipolar Transistor (IGBT)

### General Information

The Bourns® Model BIDW75N65ES5 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:



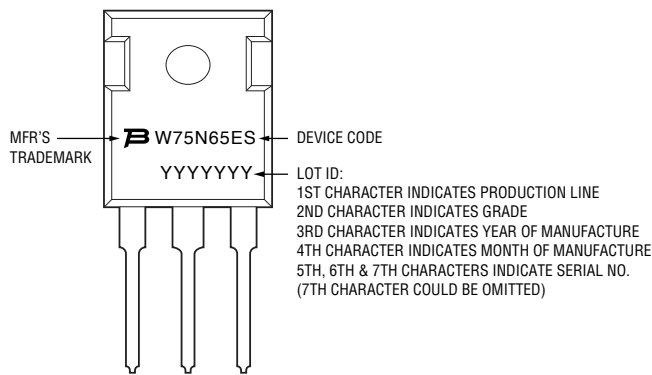
### Maximum Electrical Ratings ( $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise specified)

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CES}$	650	V
Continuous Collector Current ( $T_C = 25\text{ }^\circ\text{C}$ ), limited by $T_{jmax}$	$I_C$	150	A
Continuous Collector Current ( $T_C = 100\text{ }^\circ\text{C}$ ), limited by $T_{jmax}$	$I_C$	75	A
Pulsed Collector Current, $t_p$ limited by $T_{jmax}$	$I_{CP}$	300	A
Gate-Emitter Voltage	$V_{GE}$	$\pm 20$	V
Transient Gate-Emitter Voltage ( $t_p \leq 10\text{ }\mu\text{s}$ , $D < 0.01$ )	$V_{GE}$	$\pm 30$	V
Continuous Forward Current ( $T_C = 100\text{ }^\circ\text{C}$ ), limited by $T_{jmax}$	$I_F$	75	A
Total Power Dissipation	$P_{total}$	394	W
Storage Temperature	$T_{STG}$	-55 to +150	$^\circ\text{C}$
Operating Junction Temperature	$T_j$	-40 to +175	$^\circ\text{C}$

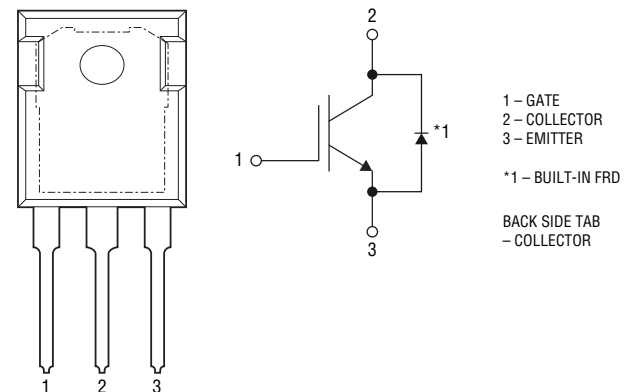
### Thermal Resistance

Parameter	Symbol	Max	Unit
IGBT Thermal Resistance Junction - Case	$R_{th(j-c)}_{IGBT}$	0.38	$^\circ\text{C/W}$
Diode Thermal Resistance Junction - Case	$R_{th(j-c)}_{Diode}$	0.4	$^\circ\text{C/W}$

### Typical Part Marking



### Internal Circuit



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# BIDW75N65ES5 Insulated Gate Bipolar Transistor (IGBT)

**BOURNS®**

## Static Electrical Characteristics ( $T_C = 25\text{ }^\circ\text{C}$ , 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	$V_{CE(sat)}$	$V_{GE} = 15\text{ V}, I_C = 75\text{ A}, T_C = 25\text{ }^\circ\text{C}$	—	1.42	1.85	V
		$V_{GE} = 15\text{ V}, I_C = 75\text{ A}, T_C = 150\text{ }^\circ\text{C}$	—	1.67	—	
Diode Forward On-Voltage	$V_F$	$I_F = 75\text{ A}, T_C = 25\text{ }^\circ\text{C}$	—	1.55	1.9	V
		$I_F = 75\text{ A}, T_C = 150\text{ }^\circ\text{C}$	—	1.52	—	V
Gate Threshold Voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C = 250\text{ }\mu\text{A}$	3.2	4.0	4.8	V
Collector Cut-off Current	$I_{CES}$	$V_{GE} = 0\text{ V}, V_{CE} = 650\text{ V}$	—	—	50	$\mu\text{A}$
Gate-Emitter Leakage Current	$I_{GES}$	$V_{CE} = 0\text{ V}, V_{GE} = \pm 20\text{ V}$	—	—	$\pm 100$	nA

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

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Input Capacitance	$C_{ies}$	$V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	—	4823	—	pF
Output Capacitance	$C_{oes}$		—	131	—	
Reverse Transfer Capacitance	$C_{res}$		—	21	—	
Total Gate Charge	$Q_g$	$V_{CE} = 520\text{ V}, V_{GE} = 15\text{ V}, I_C = 75\text{ A}$	—	184	—	nC
Gate-Emitter Charge	$Q_{ge}$		—	33	—	
Gate-Collector Charge	$Q_{gc}$		—	48	—	

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

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Turn-on Delay Time	$t_{d(on)}$	$V_{CE} = 400\text{ V}, V_{GE} = 15\text{ V}, I_C = 75\text{ A}, R_G = 10\text{ }\Omega$	—	35	—	ns
Current Rise Time	$t_r$		—	39	—	ns
Turn-off Delay Time	$t_{d(off)}$		—	194	—	ns
Current Fall Time	$t_f$		—	35	—	ns
Turn-on Switching Energy	$E_{on}$		—	1.56	—	mJ
Turn-off Switching Energy	$E_{off}$		—	1.07	—	mJ
Total Switching Energy	$E_{ts}$		—	2.63	—	mJ

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# BIDW75N65ES5 Insulated Gate Bipolar Transistor (IGBT)

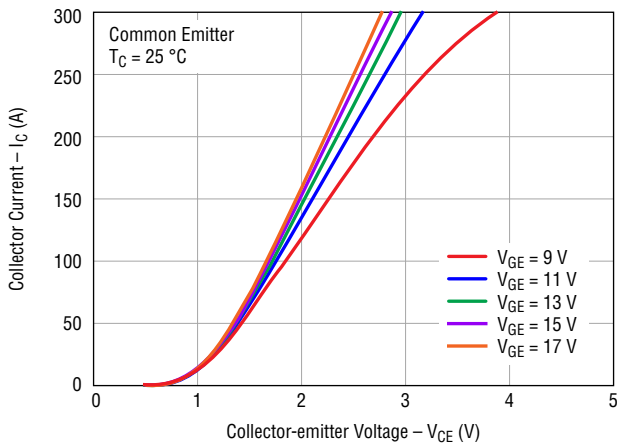


## Diode Switching Characteristics ( $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise specified)

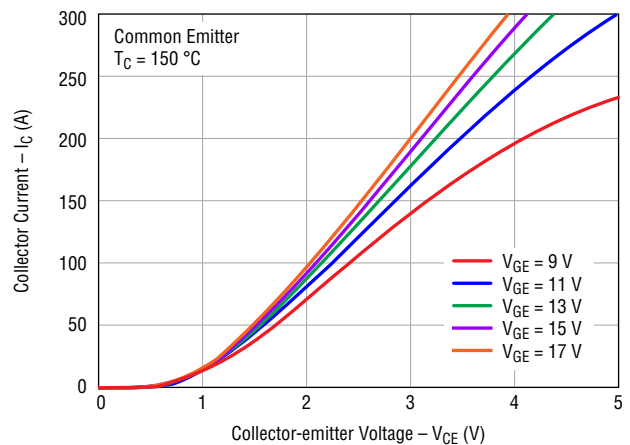
Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Reverse Recovery Time	$t_{rr}$	$di_F/dt = 200\text{ A}/\mu\text{s}$ , $I_F = 75\text{ A}$	—	123	—	ns
Reverse Recovery Charge	$Q_{rr}$		—	0.4	—	$\mu\text{C}$

## Electrical Characteristic Performance

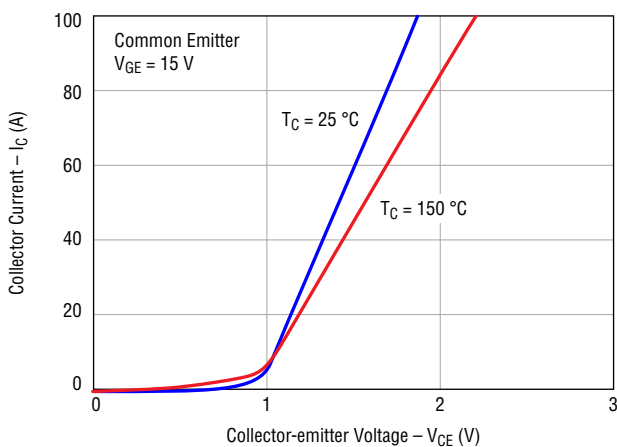
### Typical Output Characteristics



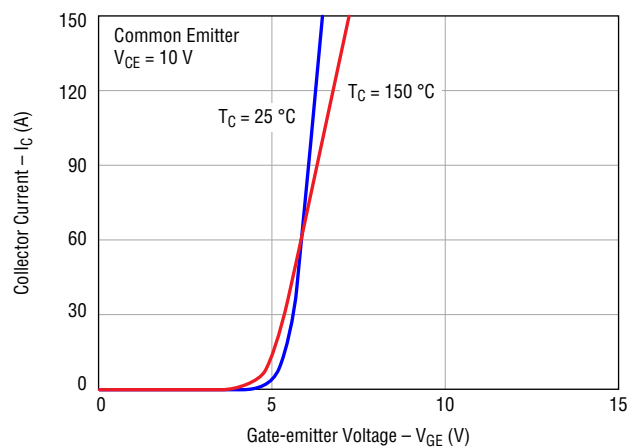
### Typical Output Characteristics



### Typical Saturation Voltage Characteristics



### Typical Transfer Characteristics



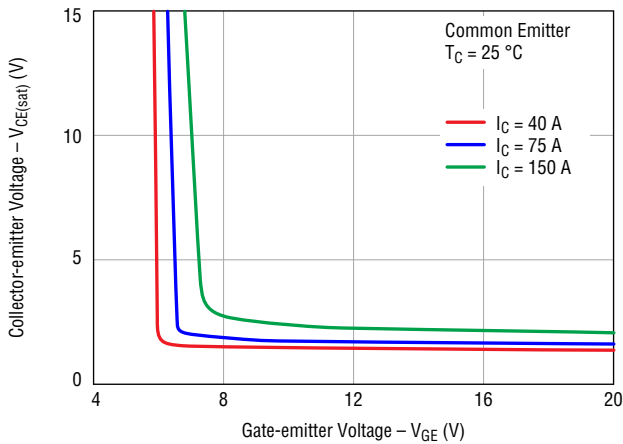
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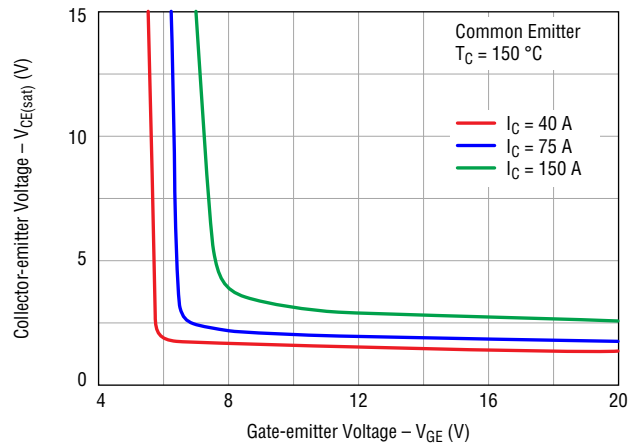
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**Electrical Characteristic Performance (continued)**

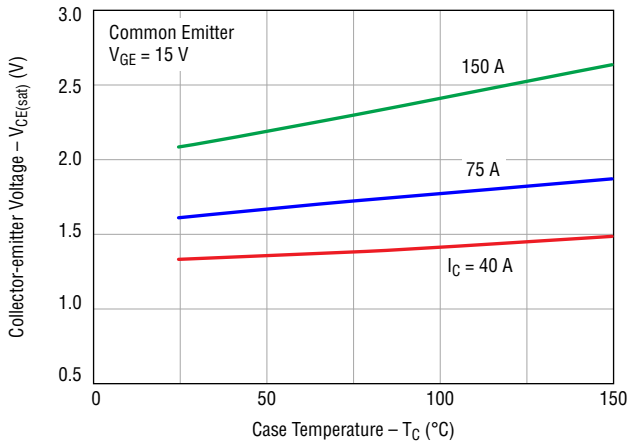
**Typical Saturation Voltage Drop vs  $V_{GE}$**



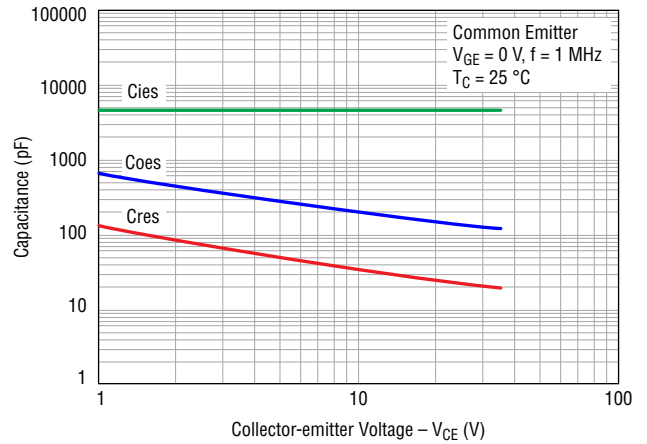
**Typical Saturation Voltage Drop vs  $V_{GE}$**



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



**Typical Capacitance Characteristics**



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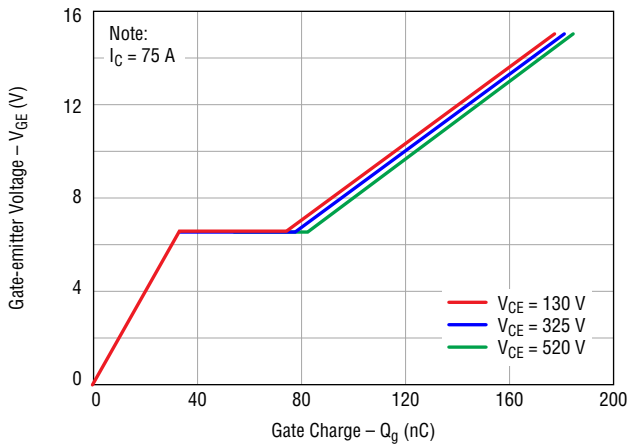
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# BIDW75N65ES5 Insulated Gate Bipolar Transistor (IGBT)

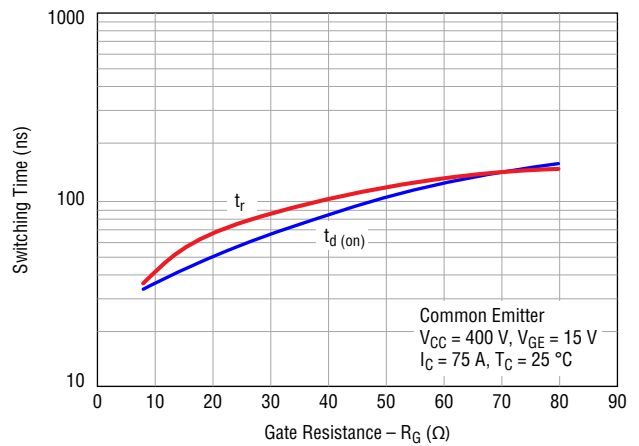


## Electrical Characteristic Performance (continued)

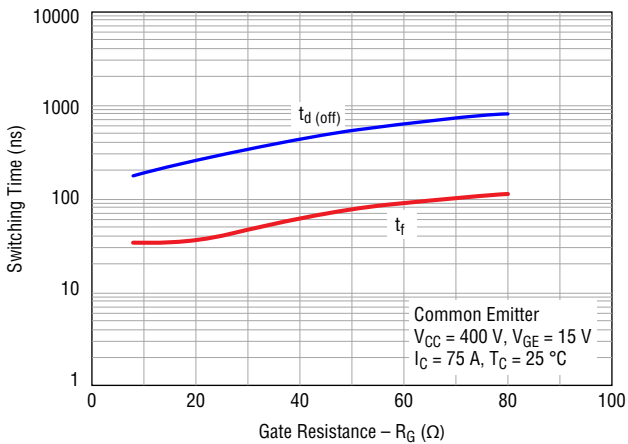
### Typical Gate Charge Characteristics



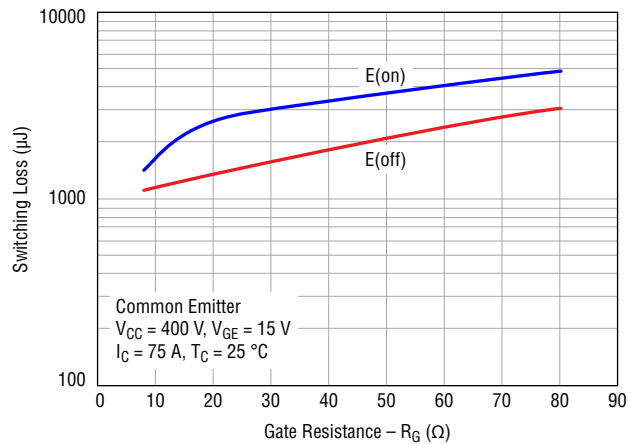
### Typical Turn-on Characteristics vs Gate Resistance



### Typical Turn-off Characteristics vs Gate Resistance



### Typical Switching Loss vs Gate Resistance



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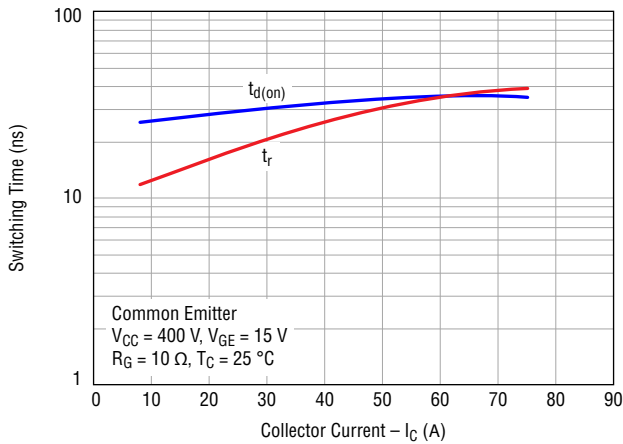
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# BIDW75N65ES5 Insulated Gate Bipolar Transistor (IGBT)

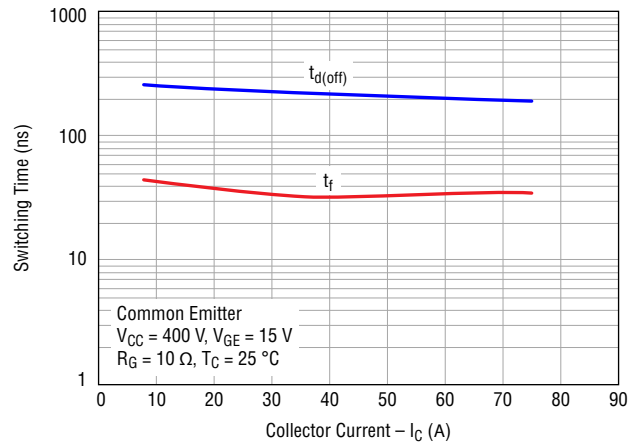


## Electrical Characteristic Performance (continued)

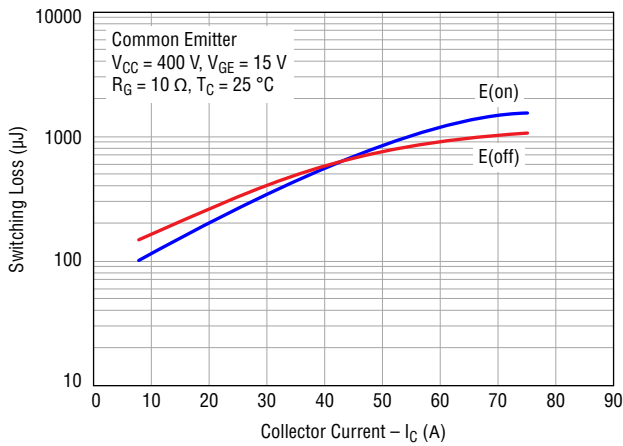
### Typical Turn-on Characteristics vs Collector Current



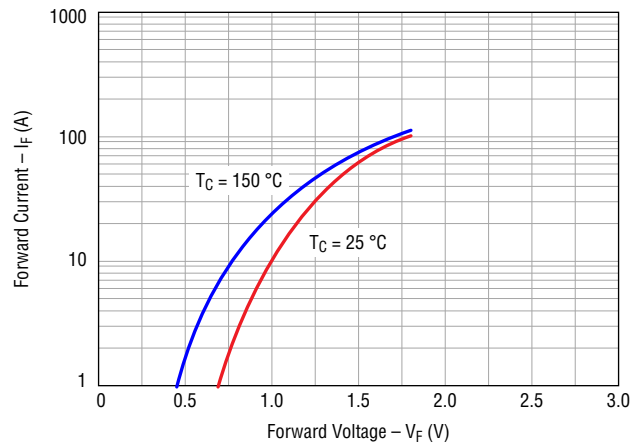
### Typical Turn-off Characteristics vs Collector Current



### Typical Switching Loss vs Collector Current



### Typical Forward Characteristics



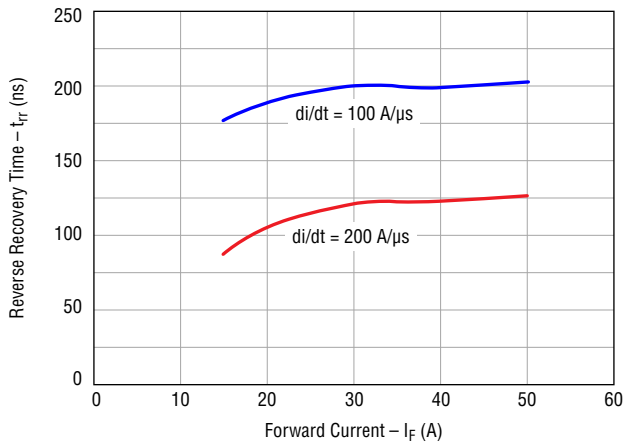
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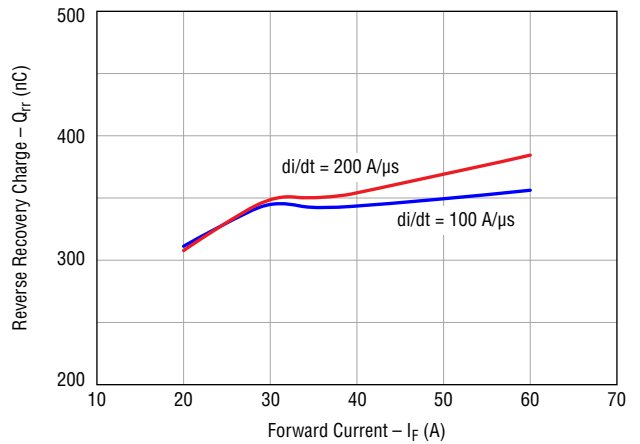
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Electrical Characteristic Performance (continued)

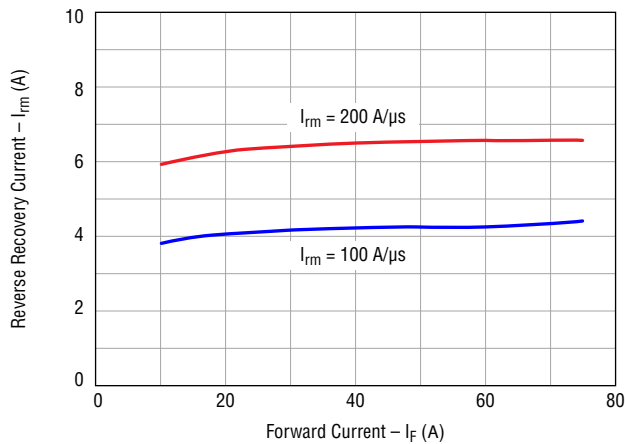
Typical Reverse Recovery Time vs Forward Current



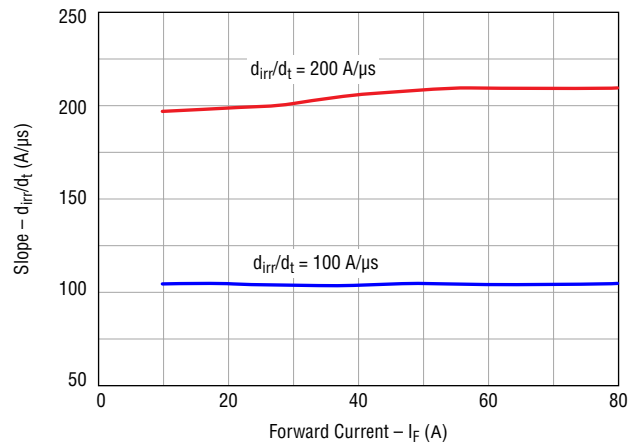
Typical Reverse Recovery Charge vs Forward Current



Typical Reverse Recovery Current vs Forward Current



Slope vs Forward Current



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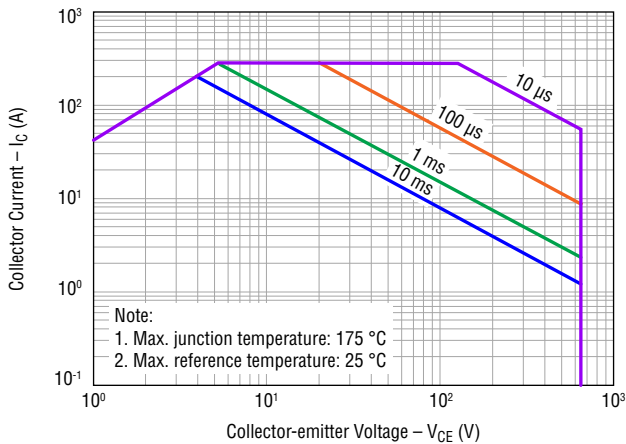
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# BIDW75N65ES5 Insulated Gate Bipolar Transistor (IGBT)



## Electrical Characteristic Performance (continued)

### Forward Bias Safe Operating Area

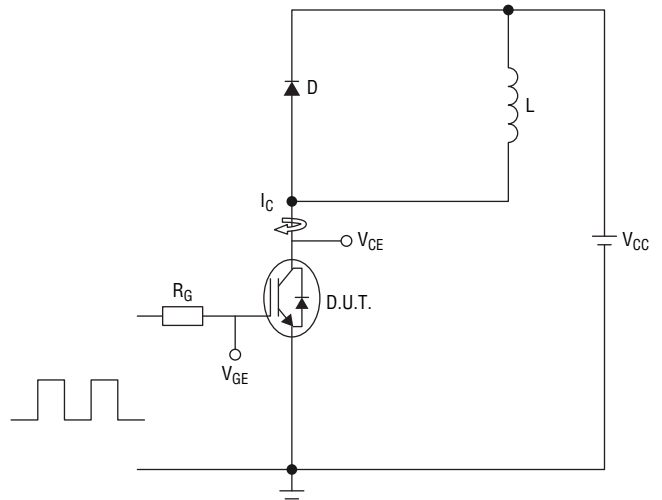


## How to Order

**B I D W 75 N 65 E S 5**

- B = Bourns®
- I = IGBT
- Type  
D = Discrete
- Package Code  
W = TO-247-3L
- Current Rating  
75 = 75 A
- Device Type  
N = N-channel
- Nominal Voltage (divided by 10)  
65 = 650 V
- Optimization  
ES = Efficient Medium Speed
- Version Number

## Inductive Load Test Circuit



$L = 100 \mu\text{H}$ ,  $V_{CE} = 400 \text{ V}$ ,  $V_{GE} = 15 \text{ V}$ ,  $I_C = 75 \text{ A}$ ,  $R_G = 10 \Omega$

## Environmental Characteristics

ESD Class (HBM) .....2

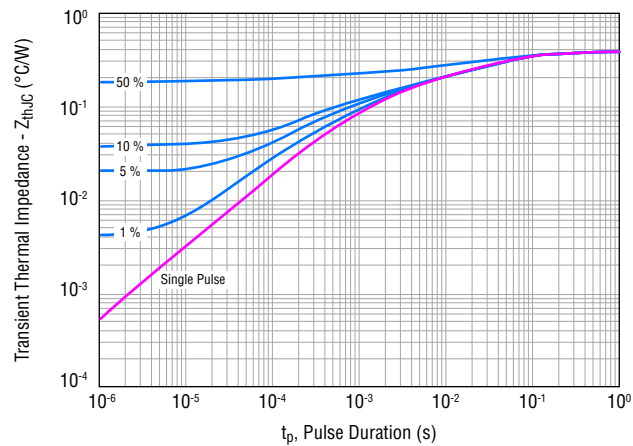


# BIDW75N65ES5 Insulated Gate Bipolar Transistor (IGBT)

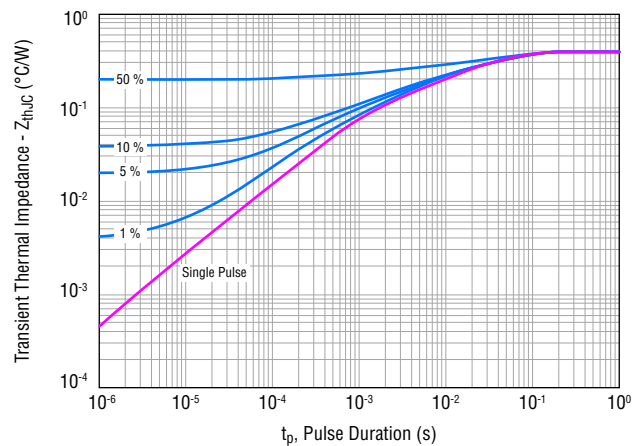


## Electrical Characteristic Performance (continued)

### 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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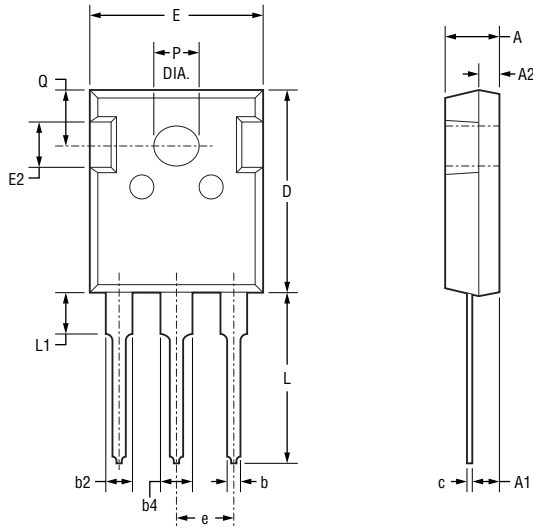
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# BIDW75N65ES5 Insulated Gate Bipolar Transistor (IGBT)



## 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	$\frac{5.44}{(.214)}$ 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

BIDW75N65ES5..... 30 pieces per tube



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