



## Features

- 600V, 5A, Low  $V_{CE(sat)}$
- Trench-Gate Field-Stop technology
- Optimized for conduction
- Robust
- RoHS compliant\*

## Applications

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

# BIDD05N60T Insulated Gate Bipolar Transistor (IGBT)

### General Information

The Bourns® Model BIDD05N60T IGBT device combines technology from a MOS gate and a bipolar transistor for an optimum component for high voltage and high current applications. This device uses Trench-Gate Field-Stop technology providing greater control of dynamic characteristics with a lower Collector-Emitter Saturation Voltage ( $V_{CE(sat)}$ ) and fewer switching losses. In addition, this structure improves the robustness of the device.

### Additional Information

Click these links for more information:



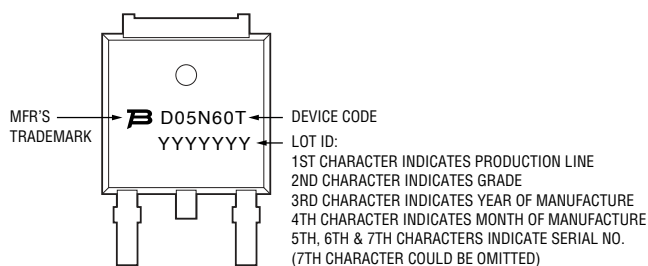
### Maximum Electrical Ratings ( $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise specified)

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CES}$	600	V
Continuous Collector Current ( $T_C = 25\text{ }^\circ\text{C}$ ), limited by $T_{jmax}$	$I_C$	10	A
Continuous Collector Current ( $T_C = 100\text{ }^\circ\text{C}$ ), limited by $T_{jmax}$	$I_C$	5	A
Pulsed Collector Current, $t_p$ limited by $T_{jmax}$	$I_{CP}$	15	A
Gate-Emitter Voltage	$V_{GE}$	$\pm 30$	V
Continuous Forward Current ( $T_C = 25\text{ }^\circ\text{C}$ ), limited by $T_{jmax}$	$I_F$	10	A
Short-circuit Withstand Time ( $V_{CE} = 300\text{ V}$ , $V_{GE} = 15\text{ V}$ )	$T_{SC}$	10	$\mu\text{s}$
Total Power Dissipation	$P_{total}$	82	W
Storage Temperature	$T_{STG}$	-55 to +150	$^\circ\text{C}$
Operating Junction Temperature	$T_j$	-55 to +150	$^\circ\text{C}$

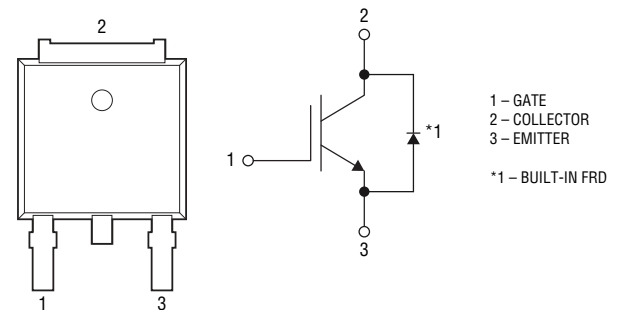
### Thermal Resistance

Parameter	Symbol	Max	Unit
IGBT Thermal Resistance Junction - Case	$R_{th(j-c)}_{IGBT}$	1.51	$^\circ\text{C/W}$
Diode Thermal Resistance Junction - Case	$R_{th(j-c)}_{Diode}$	2.14	$^\circ\text{C/W}$

### Typical Part Marking



### Internal Circuit



\*RoHS Directive 2015/863, Mar 31, 2015 and Annex. Specifications are subject to change without notice.

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# BIDD05N60T Insulated Gate Bipolar Transistor (IGBT)

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## 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	$BV_{CES}$	$V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$	600	—	—	V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE} = 15\text{ V}, I_C = 5\text{ A}$ $T_C = 25\text{ }^\circ\text{C}$	—	1.5	2.0	V
		$V_{GE} = 15\text{ V}, I_C = 5\text{ A}$ $T_C = 125\text{ }^\circ\text{C}$	—	1.7	—	
Diode Forward On-Voltage	$V_F$	$I_F = 5\text{ A}, T_C = 25\text{ }^\circ\text{C}$	—	1.3	1.8	V
		$I_F = 5\text{ A}, T_C = 125\text{ }^\circ\text{C}$	—	1.1	—	V
Gate Threshold Voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C = 250\text{ }\mu\text{A}$	3.5	5.5	6.5	V
Collector Cut-off Current	$I_{CES}$	$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}$	—	—	200	$\mu\text{A}$
Gate-Emitter Leakage Current	$I_{GES}$	$V_{CE} = 0\text{ V}, V_{GE} = \pm 20\text{ V}$	—	—	$\pm 400$	nA

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

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Input Capacitance	$C_{ies}$	$V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V},$ $f = 1\text{ MHz}$	—	340	—	pF
Output Capacitance	$C_{oes}$		—	26	—	
Reverse Transfer Capacitance	$C_{res}$		—	7.6	—	
Total Gate Charge	$Q_g$	$V_{CE} = 400\text{ V}, V_{GE} = 15\text{ V}$ $I_C = 5.0\text{ A}$	—	18.5	—	nC
Gate-Emitter Charge	$Q_{ge}$		—	5.1	—	
Gate-Collector Charge	$Q_{gc}$		—	8.6	—	

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

Parameter ( $T_C = 25\text{ }^\circ\text{C}$ )	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Turn-on Delay Time	$t_{d(on)}$	$V_{CE} = 400\text{ V}, V_{GE} = 15\text{ V}$ $I_C = 5.0\text{ A}, R_G = 10\text{ }\Omega$	—	7	—	ns
Current Rise Time	$t_r$		—	14	—	ns
Turn-off Delay Time	$t_{d(off)}$		—	18	—	ns
Current Fall Time	$t_f$		—	145	—	ns
Turn-on Switching Energy	$E_{on}$		—	0.2	—	mJ
Turn-off Switching Energy	$E_{off}$		—	0.07	—	mJ
Total Switching Energy	$E_{ts}$		—	0.27	—	mJ

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# BIDD05N60T Insulated Gate Bipolar Transistor (IGBT)

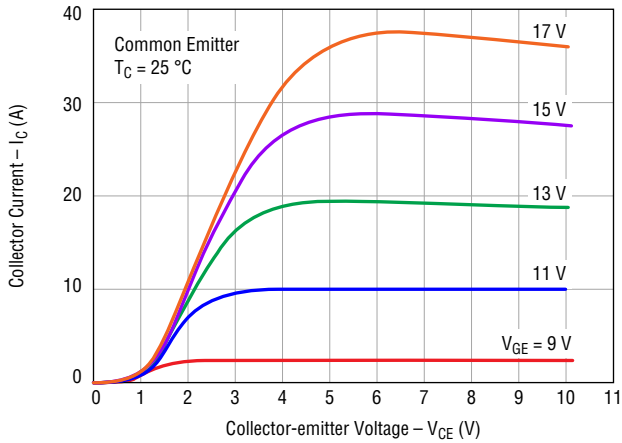
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## Diode Switching Characteristics ( $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise specified)

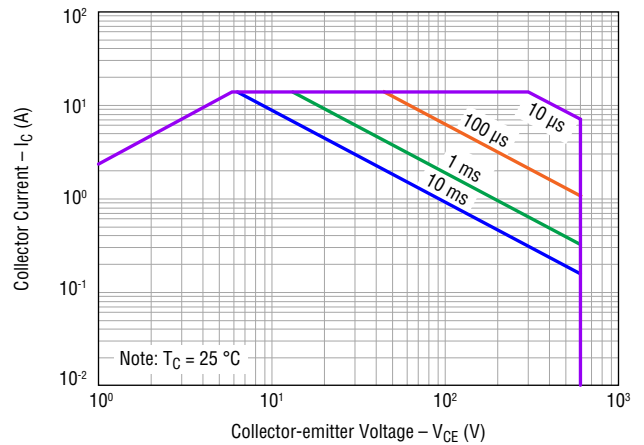
Parameter ( $T_C = 25\text{ }^\circ\text{C}$ )	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Reverse Recovery Time	$t_{rr}$	$di_F/dt = 200\text{ A}/\mu\text{s}$ $I_F = 5.0\text{ A}$	—	40	—	ns
Reverse Recovery Charge	$Q_{rr}$		—	80	—	nC

## Electrical Characteristic Performance

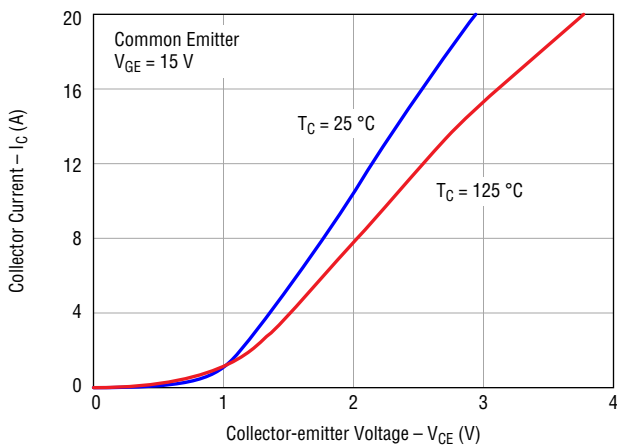
### Typical Output Characteristics



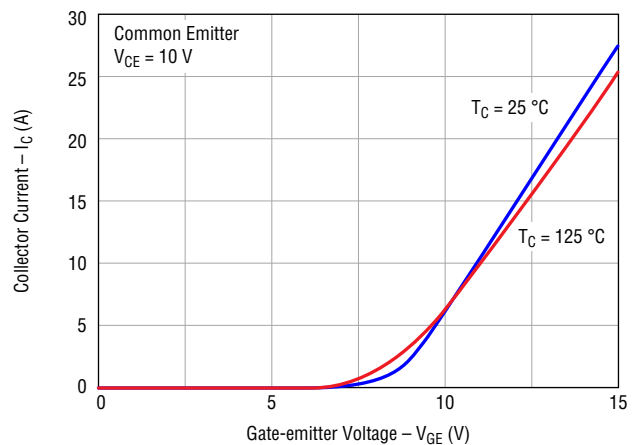
### Forward Bias Safe Operating Area



### Typical Saturation Voltage Characteristics



### Typical Transfer Characteristics



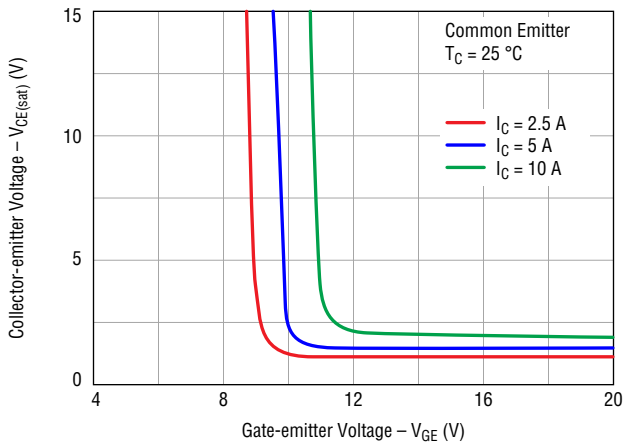
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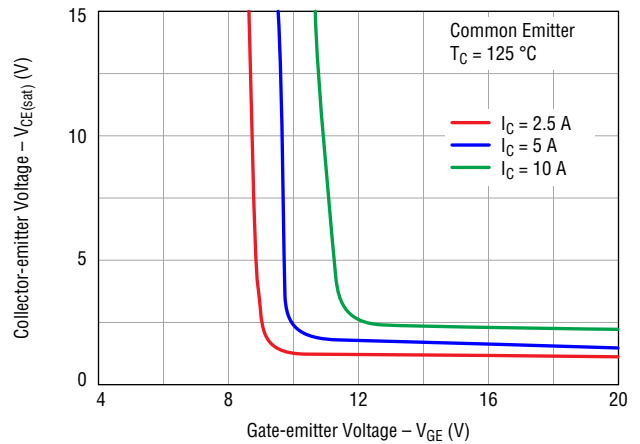
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Electrical Characteristic Performance (continued)

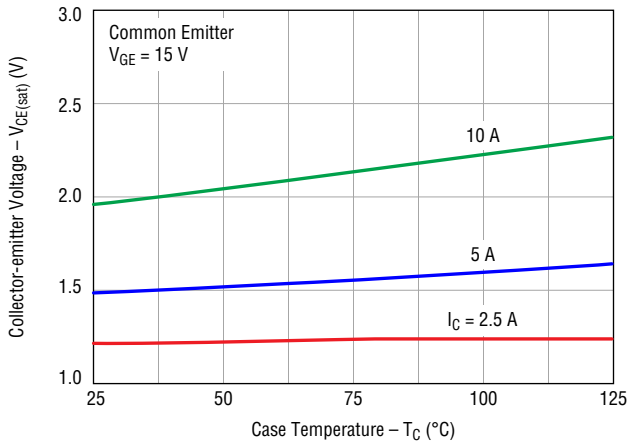
Typical  $V_{CE(sat)}$  vs  $V_{GE}$  @  $T_C = 25^\circ\text{C}$



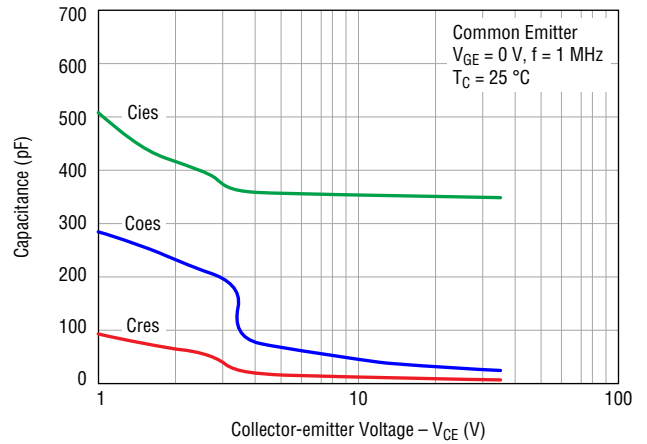
Typical  $V_{CE(sat)}$  vs  $V_{GE}$  @  $T_C = 125^\circ\text{C}$



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



Typical Capacitance Characteristics



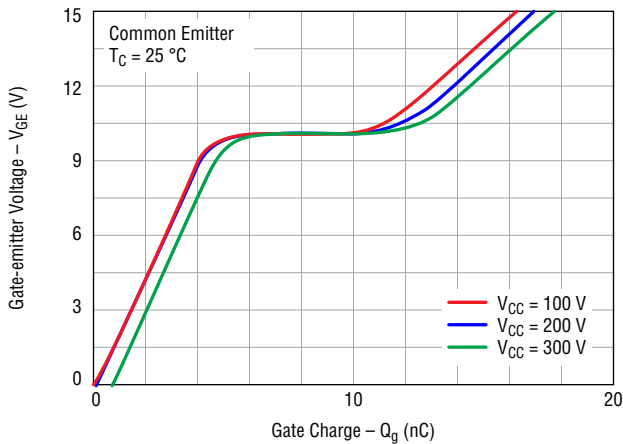
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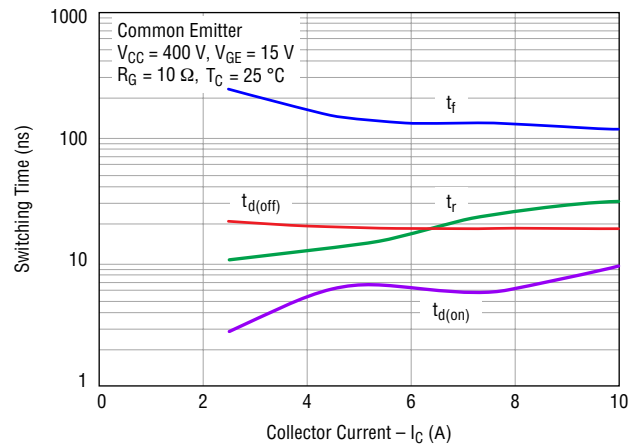
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Electrical Characteristic Performance (continued)

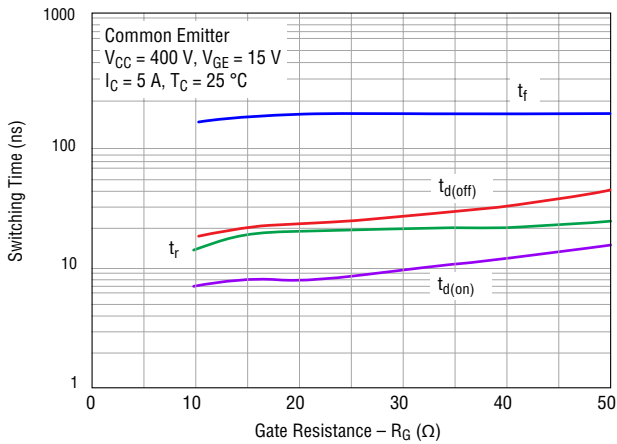
Typical Gate Charge Characteristic



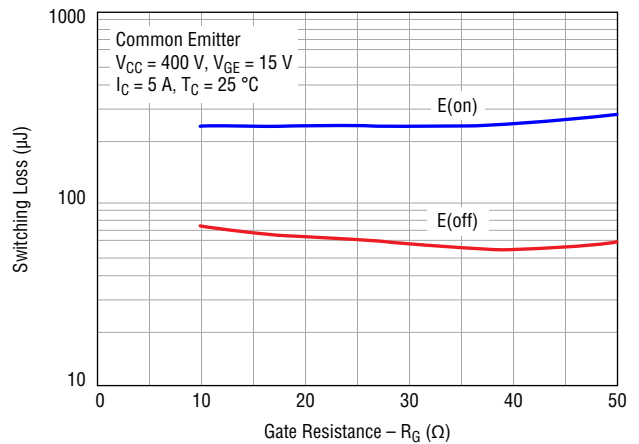
Typical Switching Time Characteristics vs  $I_C$



Typical Switching Time Characteristics vs  $R_G$

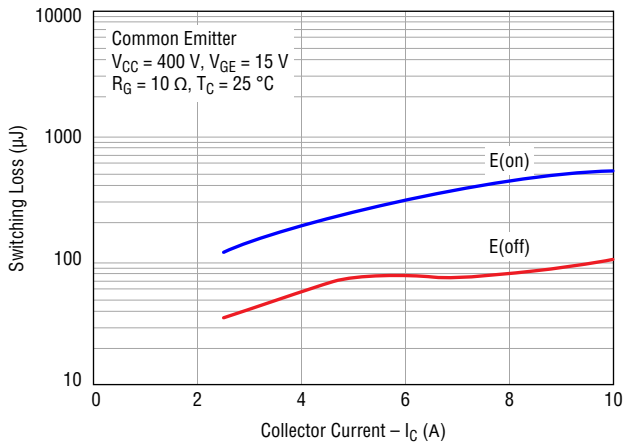


Typical Switching Loss vs  $R_G$

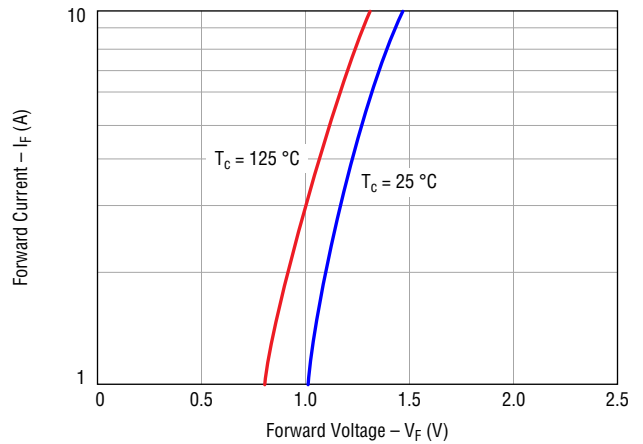


Electrical Characteristic Performance (continued)

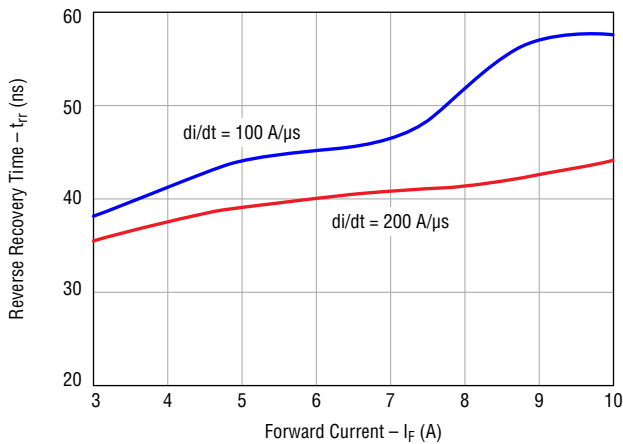
Typical Switching Loss Characteristics vs  $I_C$



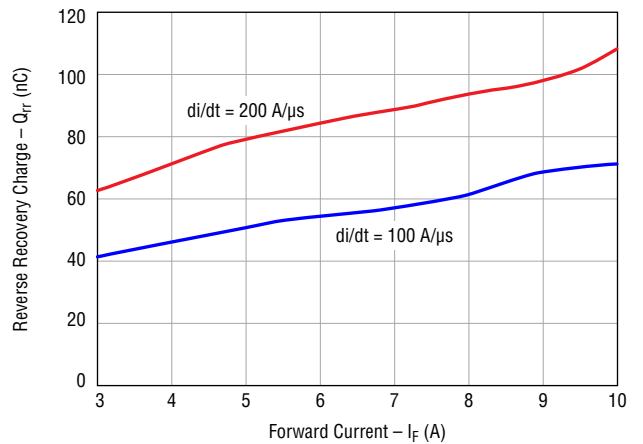
Typical Diode  $I_F$  vs  $V_F$



Typical Reverse Recovery Time vs  $I_F$



Typical Reverse Recovery Charge vs  $I_F$



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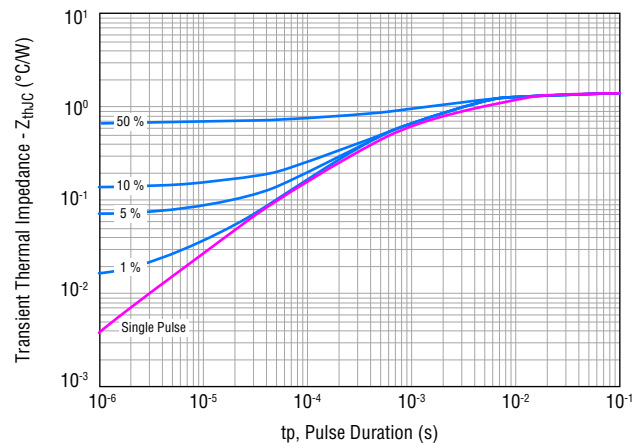
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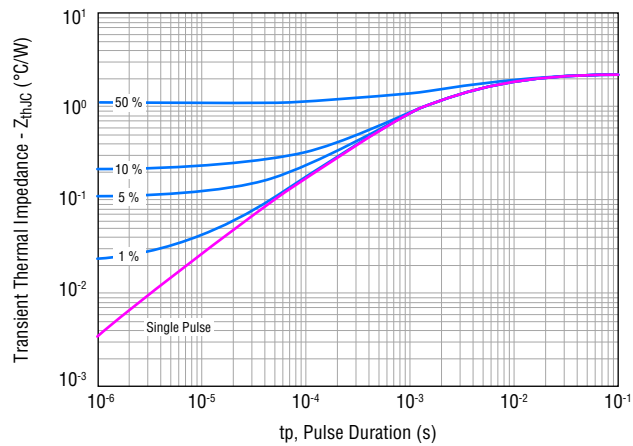
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## Electrical Characteristic Performance (continued)

### 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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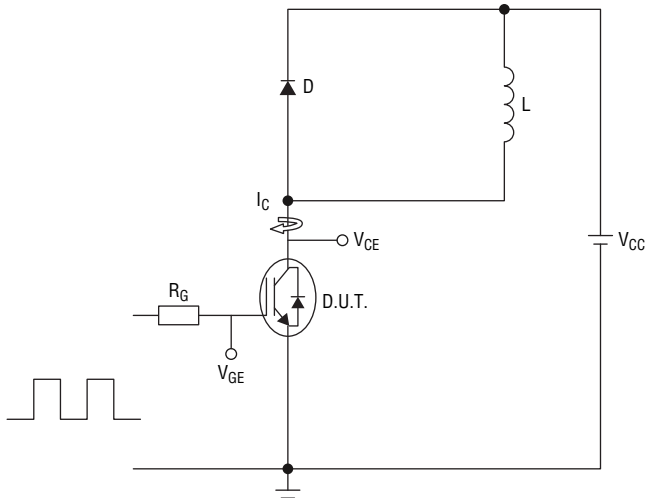
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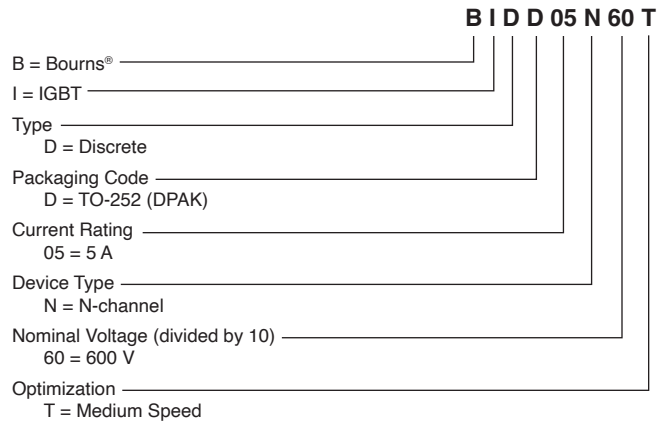
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## Inductive Load Test Circuit



$L = 11.2 \text{ mH}$ ,  $V_{CE} = 400 \text{ V}$ ,  $V_{GE} = 15 \text{ V}$ ,  $I_C = 5 \text{ A}$ ,  $R_G = 10 \Omega$

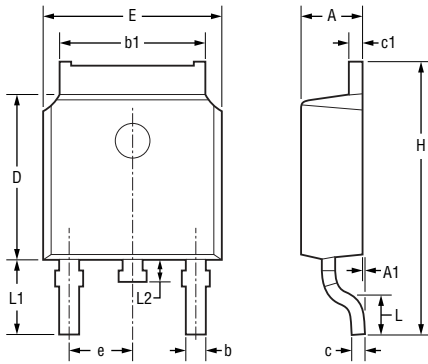
## How to Order



## Environmental Characteristics

Moisture Sensitivity Level ..... 3  
 ESD Class (HBM) ..... 1B

## Product Dimensions



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

Symbol	Min.	Nom.	Max.
A	$\frac{2.10}{(.083)}$	$\frac{2.30}{(.091)}$	$\frac{2.50}{(.098)}$
A1	0	—	$\frac{0.127}{(.005)}$
b	$\frac{0.66}{(.026)}$	$\frac{0.76}{(.030)}$	$\frac{0.89}{(.035)}$
b1	$\frac{5.10}{(.201)}$	$\frac{5.33}{(.210)}$	$\frac{5.46}{(.215)}$
c	$\frac{0.45}{(.018)}$	—	$\frac{0.65}{(.026)}$
c1	$\frac{0.45}{(.018)}$	—	$\frac{0.65}{(.026)}$
D	$\frac{5.80}{(.228)}$	$\frac{6.10}{(.240)}$	$\frac{6.40}{(.252)}$
E	$\frac{6.30}{(.248)}$	$\frac{6.60}{(.260)}$	$\frac{6.90}{(.272)}$
e	$\frac{2.30}{(.091)}$ TYP		
H	$\frac{9.60}{(.378)}$	$\frac{10.10}{(.398)}$	$\frac{10.60}{(.417)}$
L	$\frac{1.40}{(.055)}$	$\frac{1.50}{(.059)}$	$\frac{1.70}{(.067)}$
L1	$\frac{2.90}{(.114)}$ REF		
L2	$\frac{0.60}{(.024)}$	$\frac{0.80}{(.031)}$	$\frac{1.00}{(.039)}$

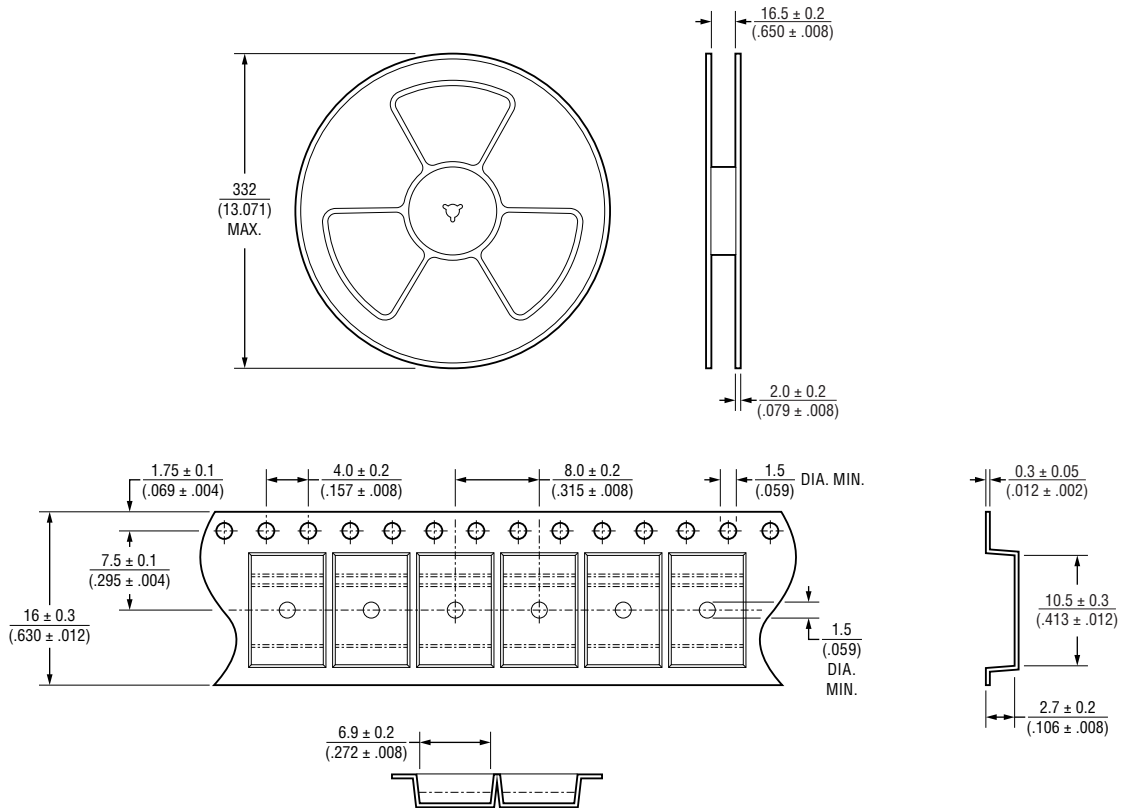
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## Packaging Specifications



DIMENSIONS:  $\frac{\text{MM}}{\text{(INCHES)}}$  USER DIRECTION OF FEED  
QTY: 2500 PCS PER REEL

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

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

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