



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

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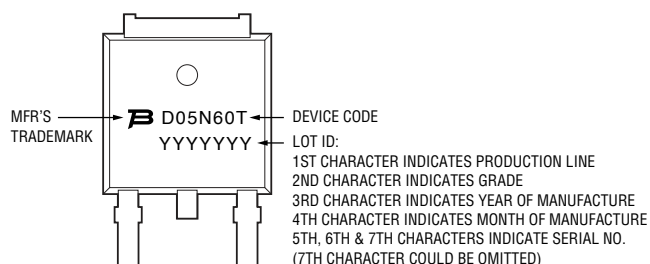
Maximum Electrical Ratings ($T_C = 25^\circ\text{C}$, unless otherwise specified)

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CES}	600	V
Continuous Collector Current ($T_C = 25^\circ\text{C}$), limited by T_{jmax}	I_C	10	A
Continuous Collector Current ($T_C = 100^\circ\text{C}$), 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}	± 30	V
Continuous Forward Current ($T_C = 25^\circ\text{C}$), 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	μs
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	$^\circ\text{C}$

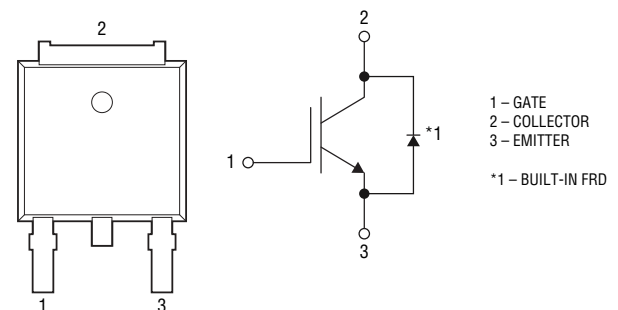
Thermal Resistance

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



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 ($T_C = 25\text{ }^\circ\text{C}$, 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	μA
Gate-Emitter Leakage Current	I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$	—	—	± 400	nA

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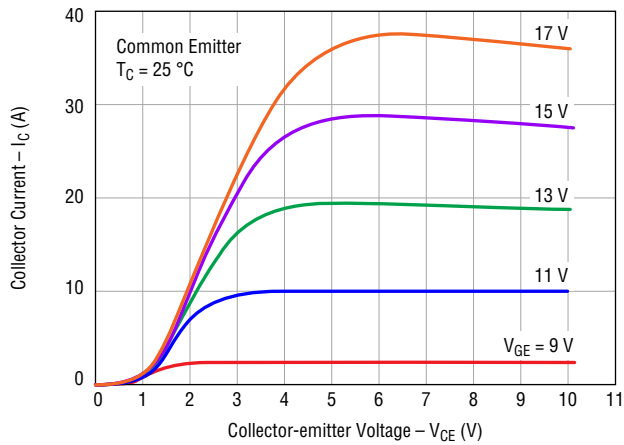
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Diode Switching Characteristics ($T_C = 25^\circ\text{C}$, unless otherwise specified)

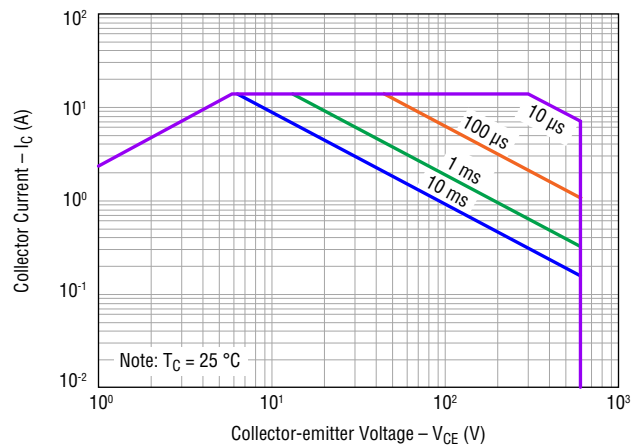
Parameter ($T_C = 25^\circ\text{C}$)	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Reverse Recovery Time	t_{rr}	$dI_F/dt = 200 \text{ A}/\mu\text{s}$ $I_F = 5.0 \text{ A}$	—	40	—	ns
Reverse Recovery Charge	Q_{rr}		—	80	—	nC

Electrical Characteristic Performance

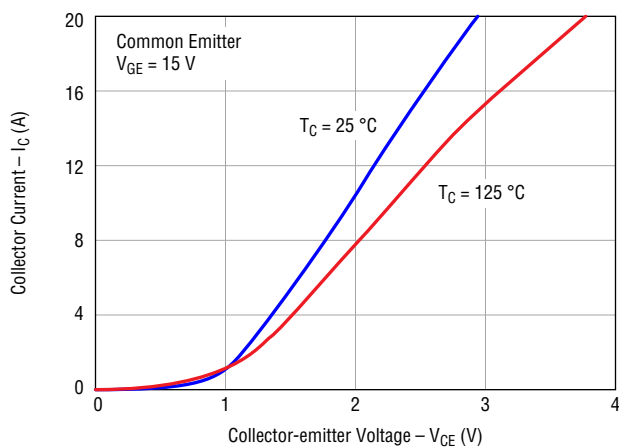
Typical Output Characteristics



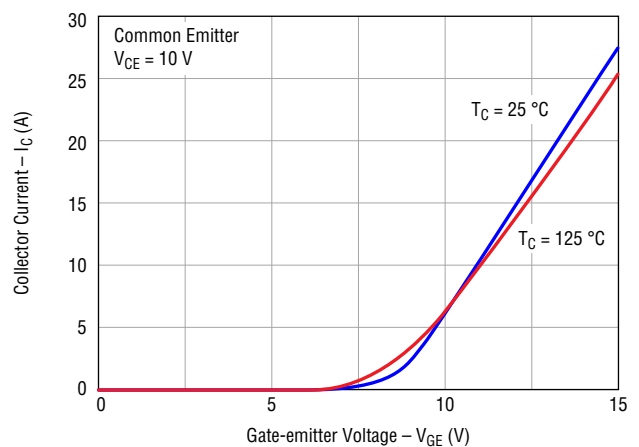
Forward Bias Safe Operating Area



Typical Saturation Voltage Characteristics



Typical Transfer Characteristics



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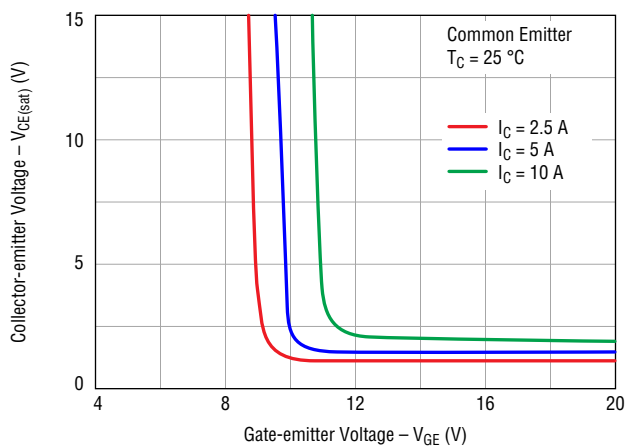
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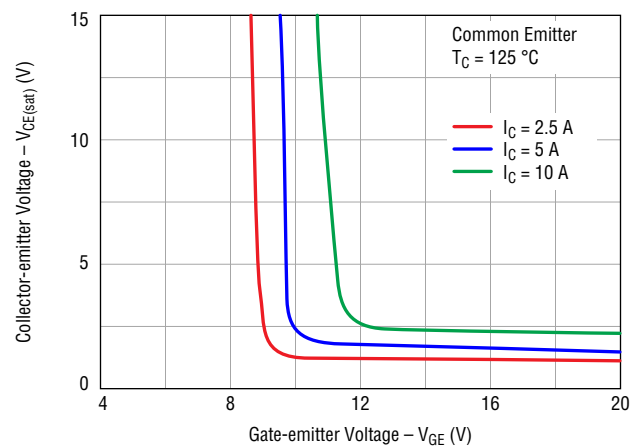
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Electrical Characteristic Performance (continued)

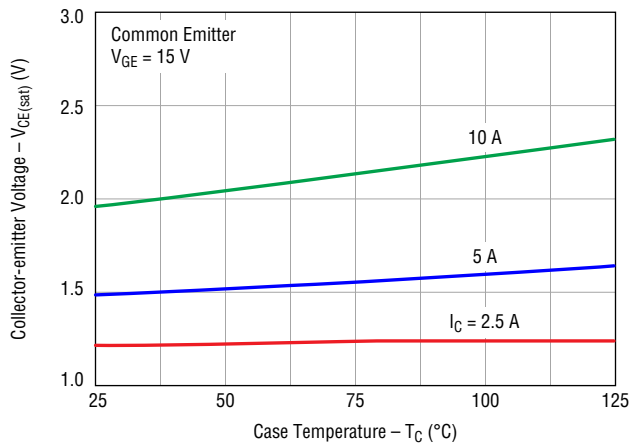
Typical $V_{CE(sat)}$ vs V_{GE} @ $T_C = 25^\circ\text{C}$



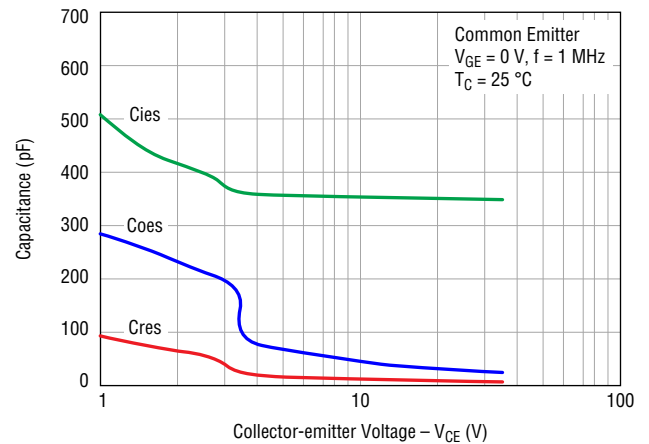
Typical $V_{CE(sat)}$ vs V_{GE} @ $T_C = 125^\circ\text{C}$



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



Typical Capacitance Characteristics



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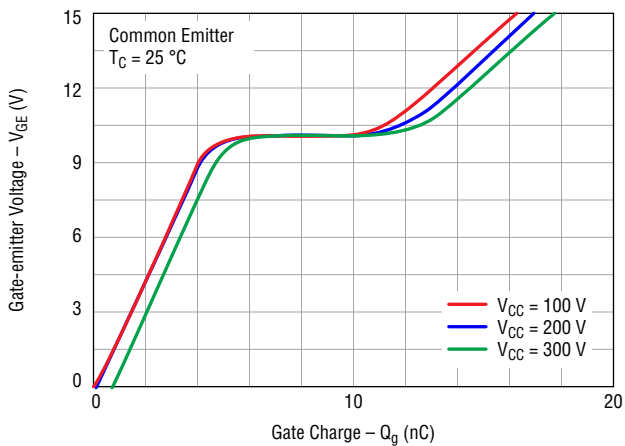
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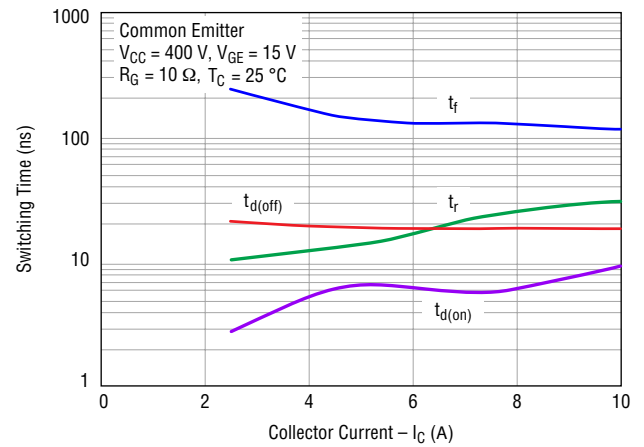
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Electrical Characteristic Performance (continued)

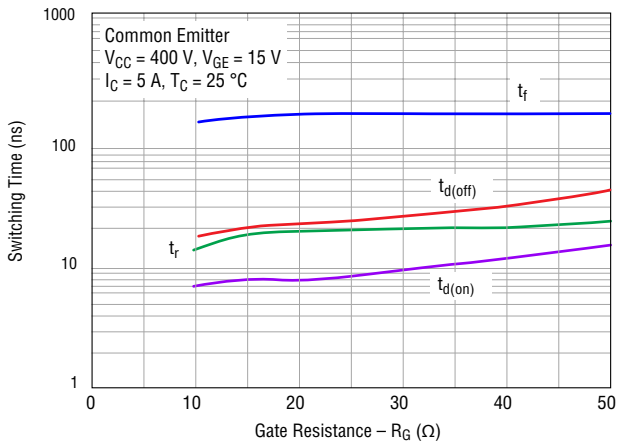
Typical Gate Charge Characteristic



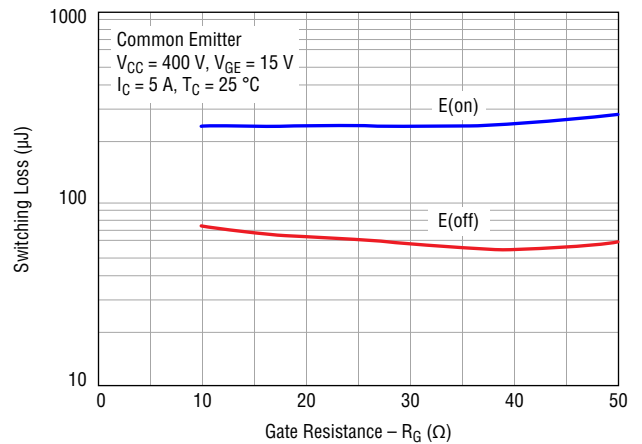
Typical Switching Time Characteristics vs I_C



Typical Switching Time Characteristics vs R_G



Typical Switching Loss vs R_G



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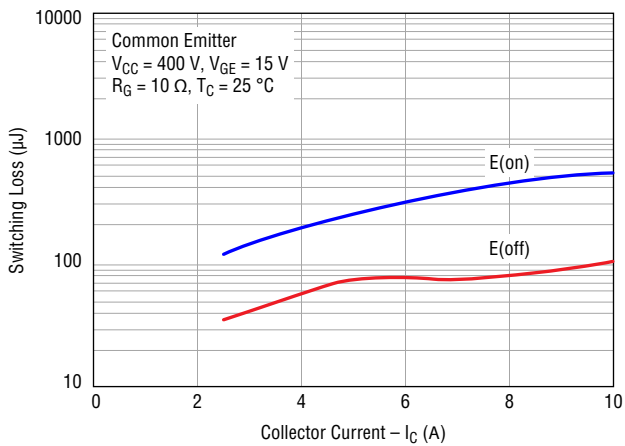
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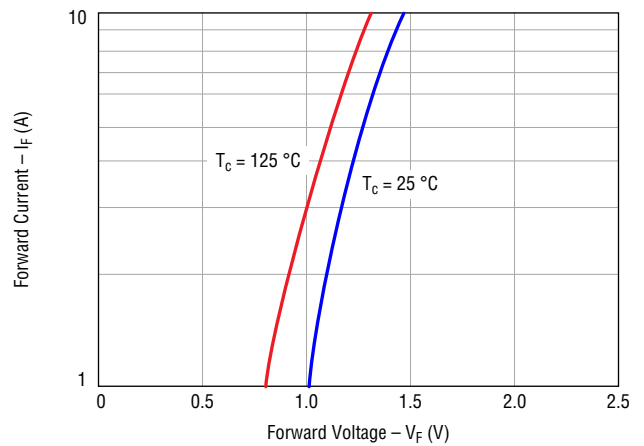
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Electrical Characteristic Performance (continued)

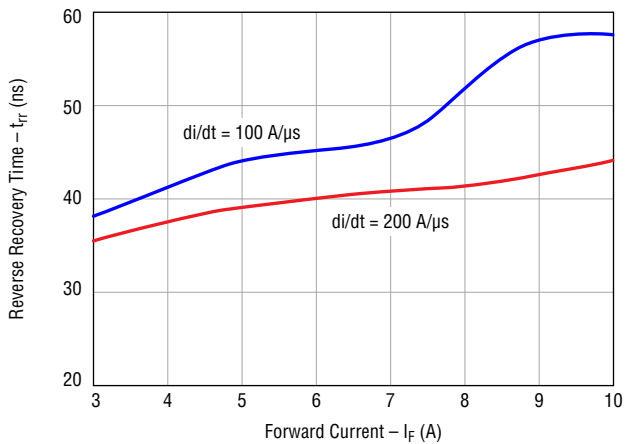
Typical Switching Loss Characteristics vs I_C



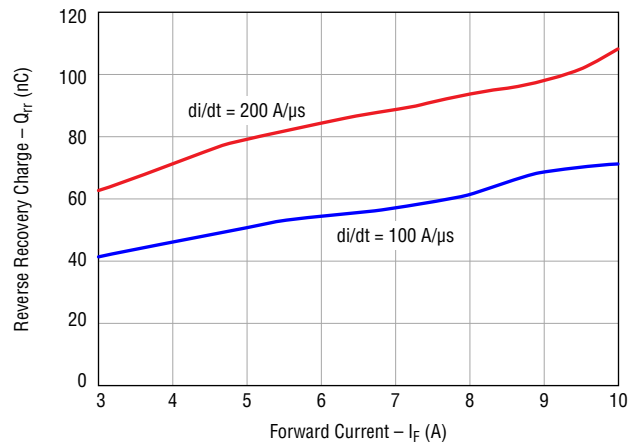
Typical Diode I_F vs V_F



Typical Reverse Recovery Time vs I_F



Typical Reverse Recovery Charge vs I_F



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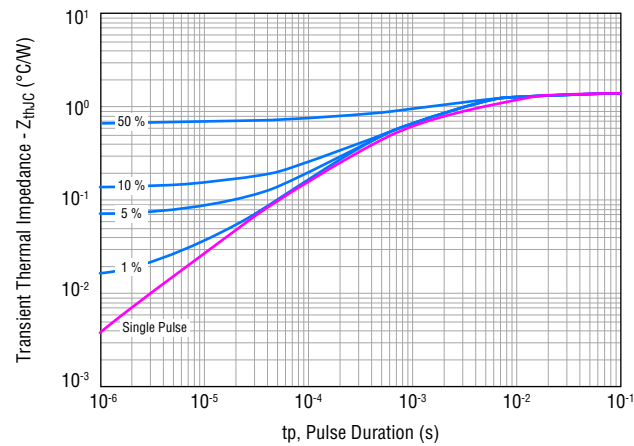
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BIDD05N60T Insulated Gate Bipolar Transistor (IGBT)

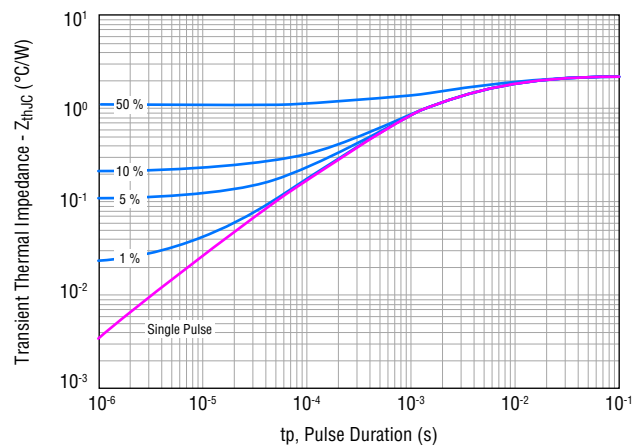
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Electrical Characteristic Performance (continued)

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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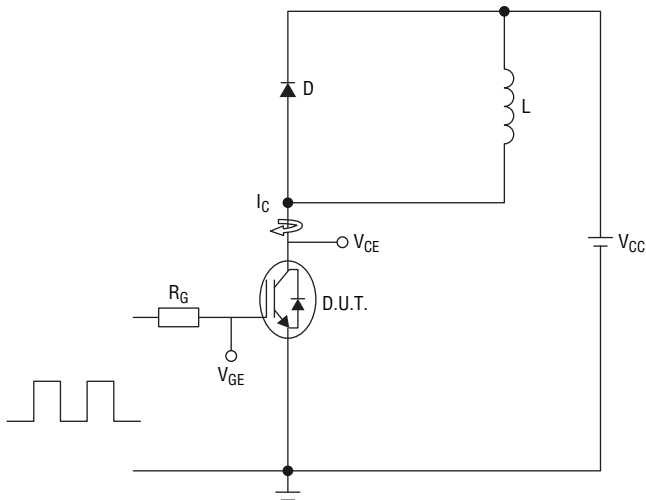
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BIDD05N60T Insulated Gate Bipolar Transistor (IGBT)

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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

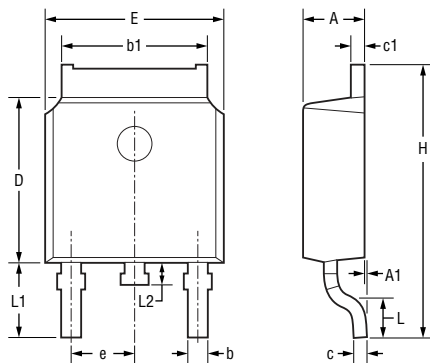
B I D D 05 N 60 T

B = Bourns®
 I = IGBT
 Type _____
 D = Discrete
 Packaging Code _____
 D = TO-252 (DPAK)
 Current Rating _____
 05 = 5 A
 Device Type _____
 N = N-channel
 Nominal Voltage (divided by 10) _____
 60 = 600 V
 Optimization _____
 T = Medium Speed

Environmental Characteristics

Moisture Sensitivity Level3
 ESD Class (HBM) 1B

Product Dimensions



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

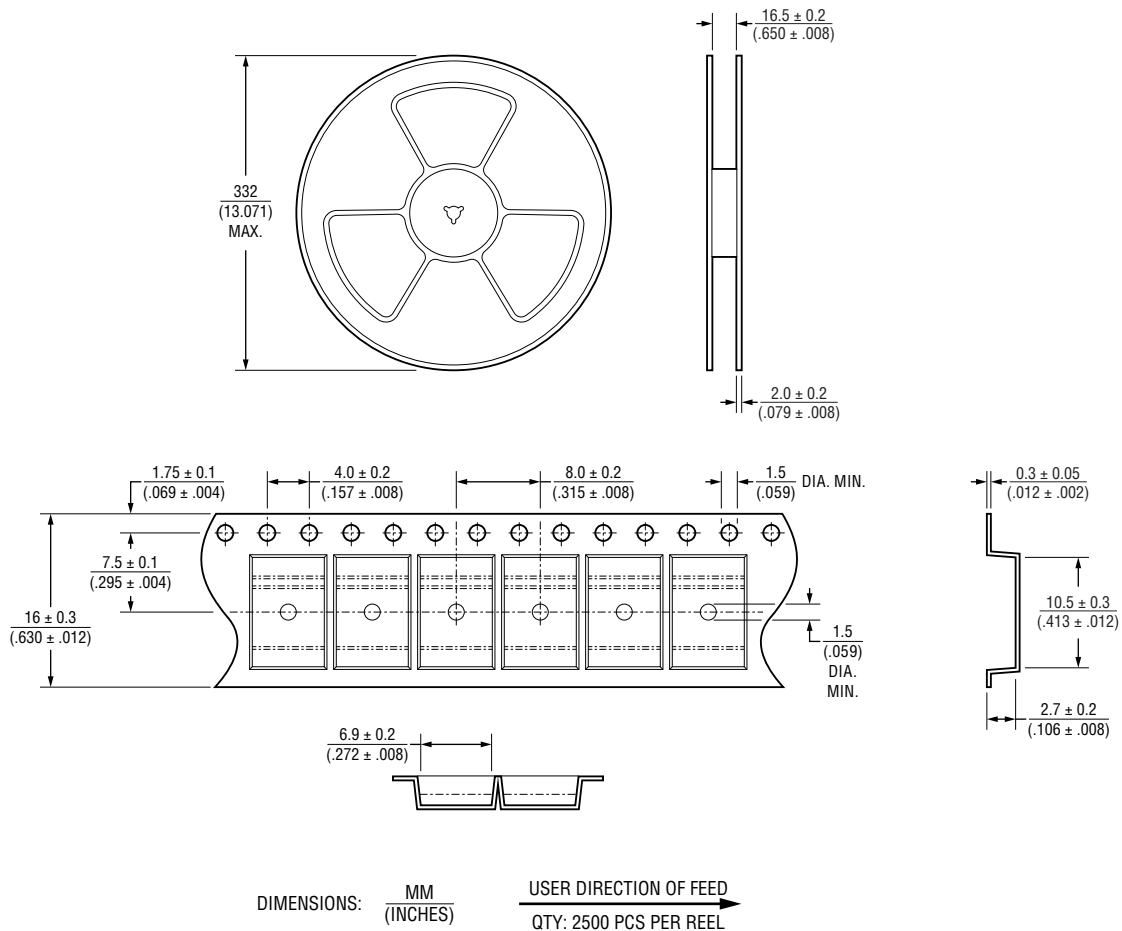
Symbol	Min.	Nom.	Max.
A	$\frac{2.10}{(.083)}$	$\frac{2.30}{(.091)}$	$\frac{2.50}{(.098)}$
A1	0	—	$\frac{0.127}{(.005)}$
b	$\frac{0.66}{(.026)}$	$\frac{0.76}{(.030)}$	$\frac{0.89}{(.035)}$
b1	$\frac{5.10}{(.201)}$	$\frac{5.33}{(.210)}$	$\frac{5.46}{(.215)}$
c	$\frac{0.45}{(.018)}$	—	$\frac{0.65}{(.026)}$
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	$\frac{2.30}{(.091)} \text{ TYP}$		
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	$\frac{2.90}{(.114)} \text{ REF}$		
L2	$\frac{0.60}{(.024)}$	$\frac{0.80}{(.031)}$	$\frac{1.00}{(.039)}$

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BIDD05N60T Insulated Gate Bipolar Transistor (IGBT)

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Packaging Specifications



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