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November 2003

**Features**

- Logic Level Gate Drive
- Internal Voltage Clamp
- ESD Gate Protection
- $T_J = 175^{\circ}\text{C}$
- Ignition Energy Capable

**Description**

This N-Channel IGBT is a MOS gated, logic level device which is intended to be used as an ignition coil driver in automotive ignition circuits. Unique features include an active voltage clamp between the collector and the gate which provides Self Clamped Inductive Switching (SCIS) capability in ignition circuits. Internal diodes provide ESD protection for the logic level gate. Both a series resistor and a shunt resistor are provided in the gate circuit.

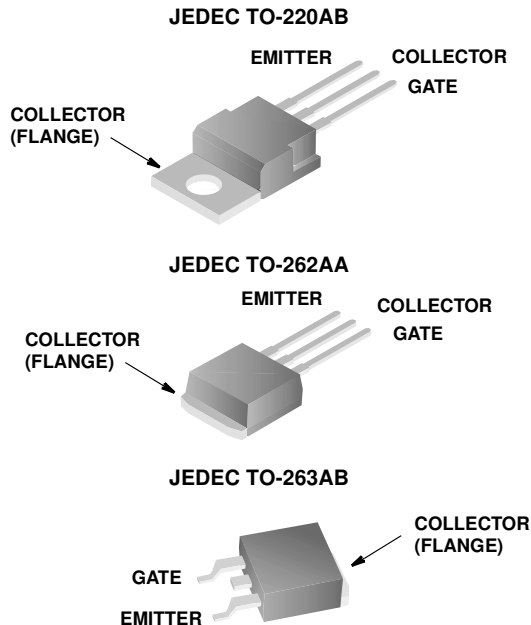
**PACKAGING AVAILABILITY**

PART NUMBER	PACKAGE	BRAND
HGTP20N35G3VL	T0-220AB	20N35GVL
HGT1S20N35G3VL	T0-262AA	20N35GVL
HGT1S20N35G3VLS	T0-263AB	20N35GVL

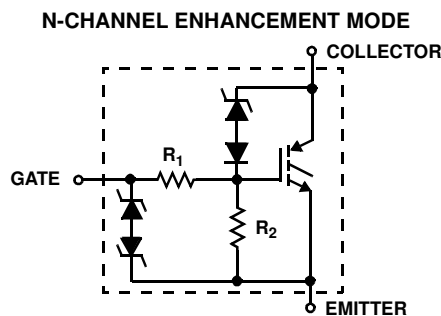
NOTE: When ordering, use the entire part number. Add the suffix 9A to obtain the TO-263AB variant in the tape and reel, i.e., HGT1S20N35G3VLS9A.

The development type number for this device is TA49076.

**Packages**



**Terminal Diagram**



**Absolute Maximum Ratings**  $T_C = +25^{\circ}\text{C}$ , Unless Otherwise Specified

	HGTP20N35G3VL HGT1S20N35G3VL HGT1S20N35G3VLS	UNITS
Collector-Emitter Bkdn Voltage At 10mA, $R_{GE} = 1\text{k}\Omega$ . . . . .	375	V
Emitter-Collector Bkdn Voltage At 10mA . . . . .	24	V
Collector Current Continuous At $V_{GE} = 5.0\text{V}$ , $T_C = +25^{\circ}\text{C}$ , Figure 7 . . . . .	20	A
At $V_{GE} = 5.0\text{V}$ , $T_C = +100^{\circ}\text{C}$ . . . . .	20	A
Gate-Emitter-Voltage (Note) . . . . .	$\pm 10$	V
Inductive Switching Current At $L = 2.3\text{mH}$ , $T_C = +25^{\circ}\text{C}$ . . . . .	21	A
At $L = 2.3\text{mH}$ , $T_C = +150^{\circ}\text{C}$ . . . . .	16	A
Collector to Emitter Avalanche Energy At $L = 2.3\text{mH}$ , $T_C = +25^{\circ}\text{C}$ . . . . .	500	mJ
Power Dissipation Total At $T_C = +25^{\circ}\text{C}$ . . . . .	150	W
Power Dissipation Derating $T_C > +25^{\circ}\text{C}$ . . . . .	1.0	W/ $^{\circ}\text{C}$
Operating and Storage Junction Temperature Range . . . . .	-40 to +175	$^{\circ}\text{C}$
Maximum Lead Temperature for Soldering . . . . .	260	$^{\circ}\text{C}$
Electrostatic Voltage at 100pF, 1500 $\Omega$ . . . . .	6	KV

NOTE: May be exceeded if  $I_{GEM}$  is limited to 10mA.

## Specifications HGTP20N35G3VL, HGT1S20N35G3VL, HGT1S20N35G3VLS

### Electrical Specifications $T_C = +25^\circ\text{C}$ , Unless Otherwise Specified

PARAMETERS	SYMBOL	TEST CONDITIONS	LIMITS			UNITS	
			MIN	TYP	MAX		
Collector-Emitter Breakdown Voltage	$BV_{CES}$	$I_C = 10\text{mA}$ , $V_{GE} = 0\text{V}$	$T_C = +175^\circ\text{C}$	310	345	380	V
			$T_C = +25^\circ\text{C}$	320	350	380	V
			$T_C = -40^\circ\text{C}$	320	355	390	V
Collector-Emitter Breakdown Voltage	$BV_{CER}$	$I_C = 10\text{mA}$ $V_{GE} = 0\text{V}$ $R_{GE} = 1\text{k}\Omega$	$T_C = +175^\circ\text{C}$	300	340	375	V
			$T_C = +25^\circ\text{C}$	315	345	375	V
			$T_C = -40^\circ\text{C}$	315	350	390	V
Gate-Emitter Plateau Voltage	$V_{GEP}$	$I_C = 10\text{A}$ $V_{CE} = 12\text{V}$	$T_C = +25^\circ\text{C}$	-	3.7	-	V
Gate Charge	$Q_{G(ON)}$	$I_C = 10\text{A}$ $V_{GE} = 5\text{V}$ $V_{CE} = 12\text{V}$	$T_C = +25^\circ\text{C}$	-	28.7	-	nC
Collector-Emitter Clamp Bkdn. Voltage	$BV_{CE(CL)}$	$I_C = 10\text{A}$ $R_G = 0\Omega$	$T_C = +175^\circ\text{C}$	325	360	395	V
Emitter-Collector Breakdown Voltage	$BV_{ECS}$	$I_C = 10\text{mA}$	$T_C = +25^\circ\text{C}$	20	32	-	V
Collector-Emitter Leakage Current	$I_{CES}$	$V_{CE} = 250\text{V}$	$T_C = +25^\circ\text{C}$	-	-	5	$\mu\text{A}$
		$V_{CE} = 250\text{V}$	$T_C = +175^\circ\text{C}$	-	-	250	$\mu\text{A}$
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	$I_C = 10\text{A}$ $V_{GE} = 4.5\text{V}$	$T_C = +25^\circ\text{C}$	-	1.3	1.6	V
			$T_C = +175^\circ\text{C}$	-	1.25	1.5	V
		$I_C = 20\text{A}$ $V_{GE} = 5.0\text{V}$	$T_C = +25^\circ\text{C}$	-	1.6	2.8	V
			$T_C = +175^\circ\text{C}$	-	1.9	3.5	V
Gate-Emitter Threshold Voltage	$V_{GE(TH)}$	$I_C = 1\text{mA}$ $V_{CE} = V_{GE}$	$T_C = +25^\circ\text{C}$	1.3	1.8	2.3	V
Gate Series Resistance	$R_1$		$T_C = +25^\circ\text{C}$	-	1.0	-	$\text{k}\Omega$
Gate-Emitter Resistance	$R_2$		$T_C = +25^\circ\text{C}$	10	17	25	$\text{k}\Omega$
Gate-Emitter Leakage Current	$I_{GES}$	$V_{GE} = \pm 10\text{V}$		$\pm 400$	$\pm 590$	$\pm 1000$	$\mu\text{A}$
Gate-Emitter Breakdown Voltage	$BV_{GES}$	$I_{GES} = \pm 2\text{mA}$		$\pm 12$	$\pm 14$	-	V
Current Turn-Off Time-Inductive Load	$t_{D(OFF)I} + t_{F(OFF)I}$	$I_C = 10\text{A}$ , $R_G = 25\Omega$ , $L = 550\mu\text{H}$ , $R_L = 26.4\Omega$ , $V_{GE} = 5\text{V}$ , $V_{CL} = 300\text{V}$ , $T_C = +175^\circ\text{C}$		-	15	30	$\mu\text{s}$
Inductive Use Test	$I_{SCIS}$	$L = 2.3\text{mH}$ , $V_G = 5\text{V}$ , $R_G = 0\Omega$	$T_C = +150^\circ\text{C}$	16	-	-	A
			$T_C = +25^\circ\text{C}$	21	-	-	A
Thermal Resistance	$R_{\theta JC}$			-	-	1.0	$^\circ\text{C}/\text{W}$

Typical Performance Curves

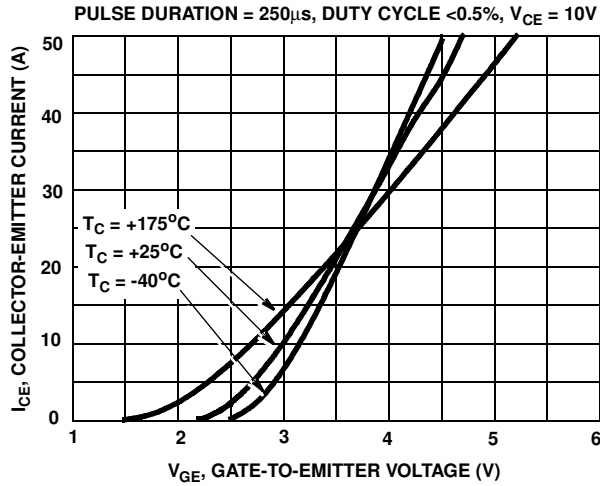


FIGURE 1. TRANSFER CHARACTERISTICS

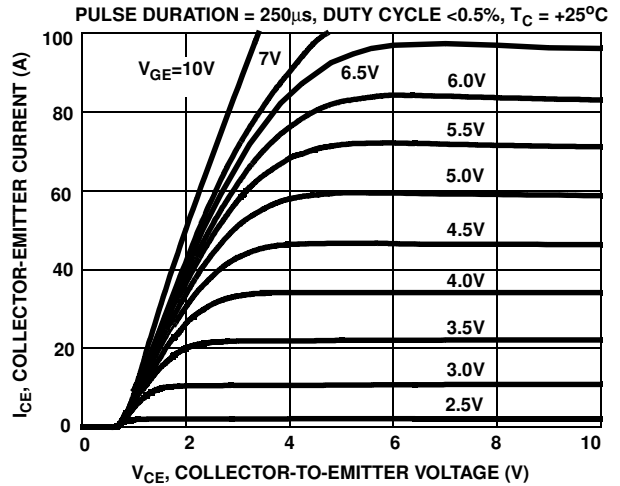


FIGURE 2. SATURATION CHARACTERISTICS

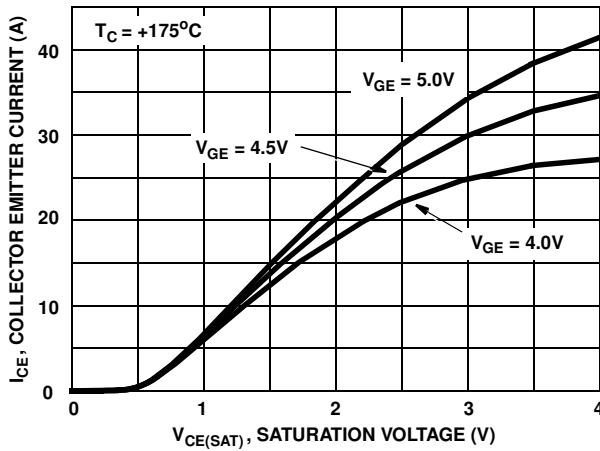


FIGURE 3. COLLECTOR-EMITTER CURRENT AS A FUNCTION OF SATURATION VOLTAGE

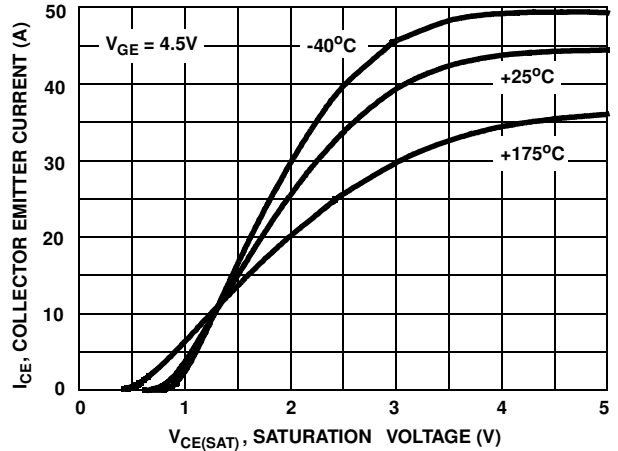


FIGURE 4. COLLECTOR-EMITTER CURRENT AS A FUNCTION OF SATURATION VOLTAGE

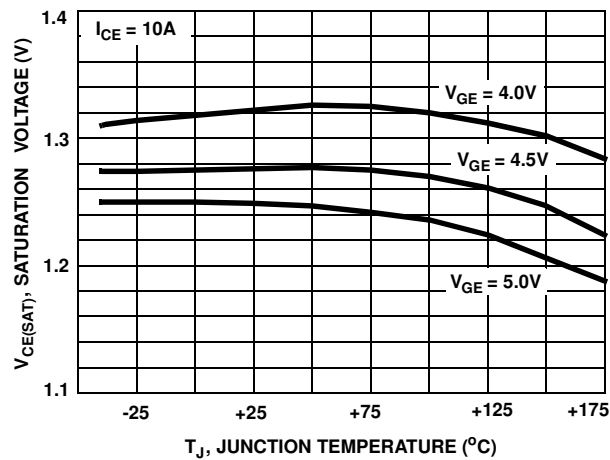


FIGURE 5. SATURATION VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE

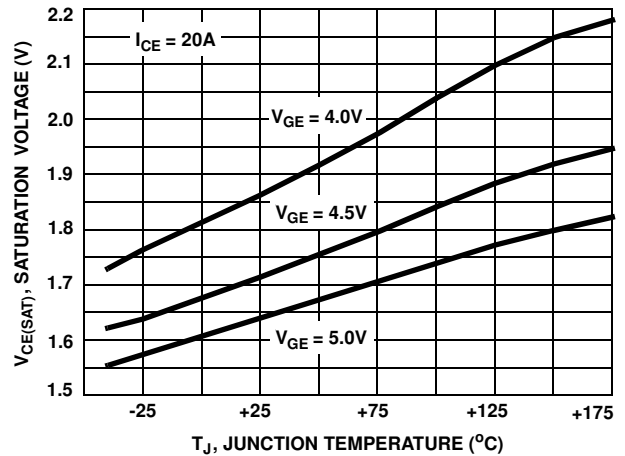


FIGURE 6. SATURATION VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE

Typical Performance Curves (Continued)

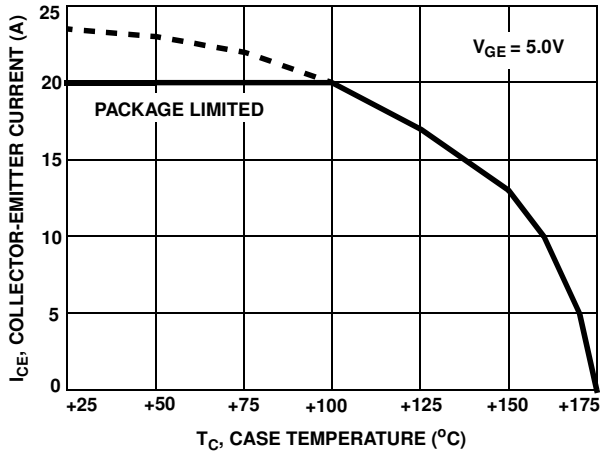


FIGURE 7. COLLECTOR-EMITTER CURRENT AS A FUNCTION OF CASE TEMPERATURE

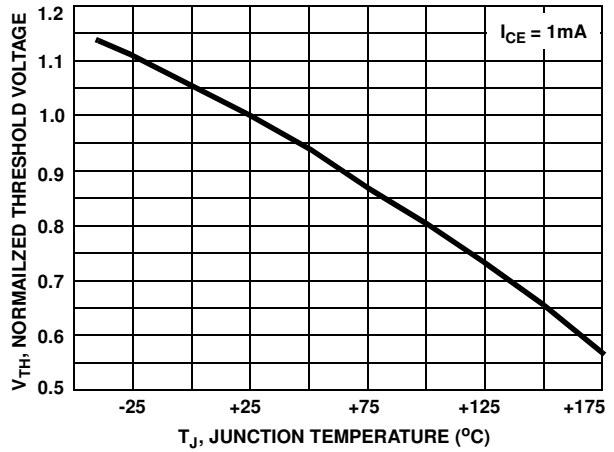


FIGURE 8. NORMALIZED THRESHOLD VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE

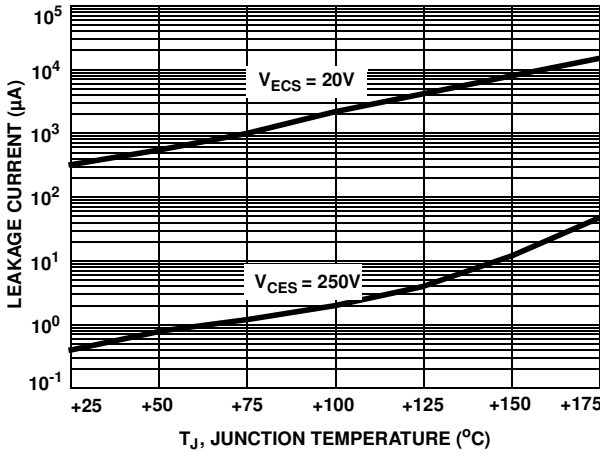


FIGURE 9. LEAKAGE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE

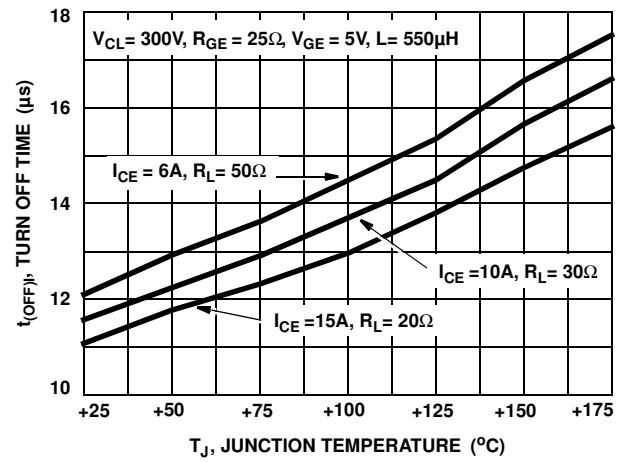


FIGURE 10. TURN-OFF TIME AS A FUNCTION OF JUNCTION TEMPERATURE

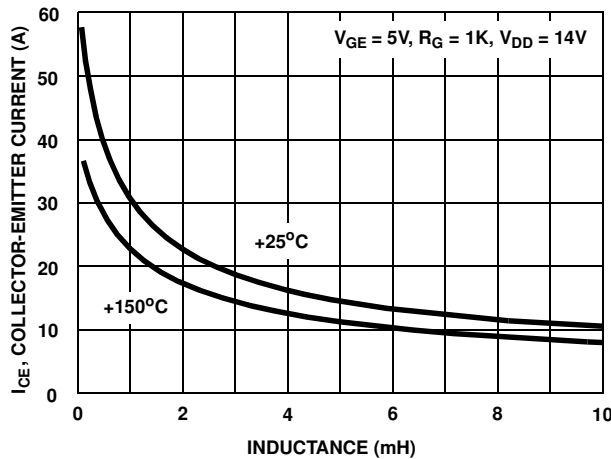


FIGURE 11. SELF CLAMPED INDUCTIVE SWITCHING CURRENT vs INDUCTANCE

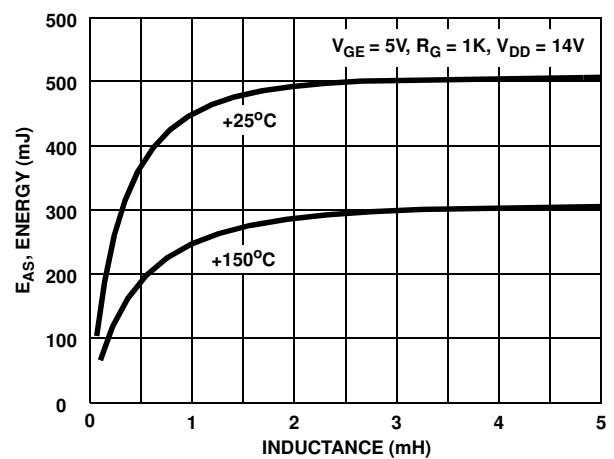


FIGURE 12. SELF CLAMPED INDUCTIVE SWITCHING ENERGY vs INDUCTANCE



Typical Performance Curves (Continued)

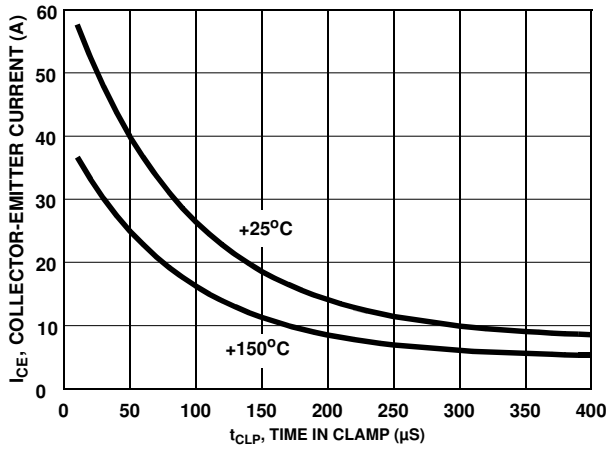


FIGURE 13. SELF CLAMPED INDUCTIVE SWITCHING CURRENT vs TIME IN CLAMP

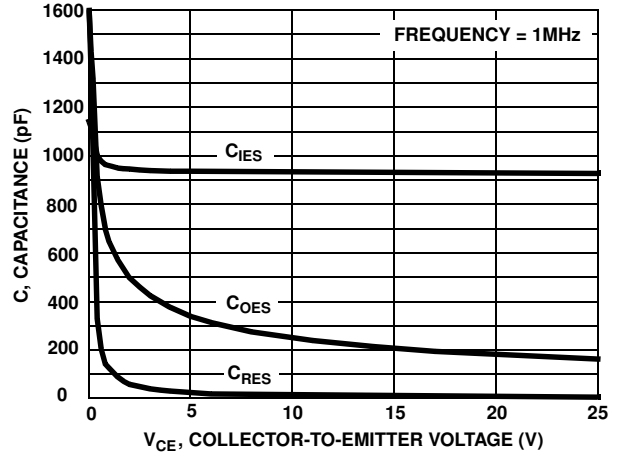


FIGURE 14. CAPACITANCE AS A FUNCTION OF COLLECTOR-EMITTER VOLTAGE

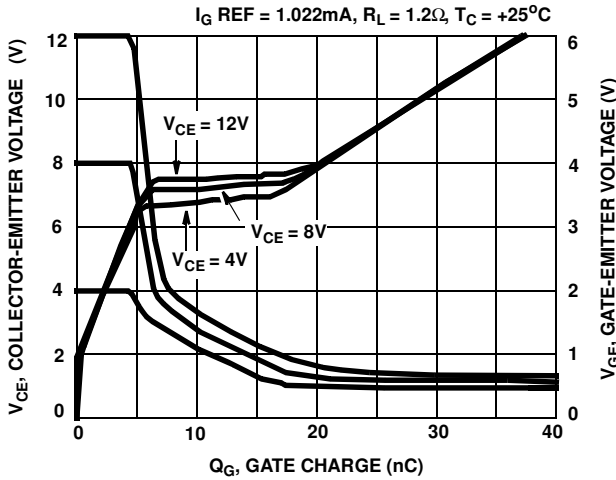


FIGURE 15. GATE CHARGE

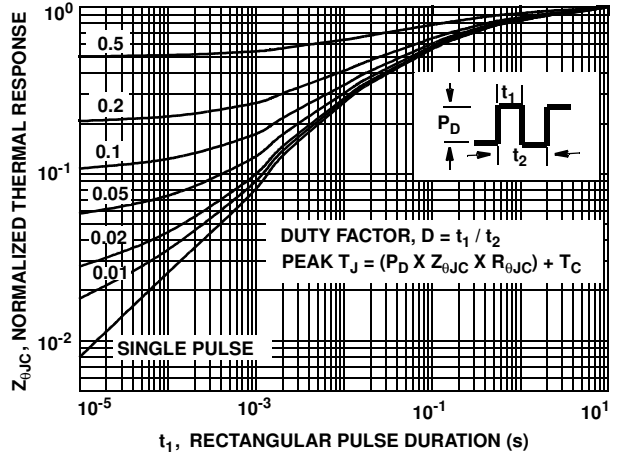


FIGURE 16. NORMALIZED TRANSIENT THERMAL IMPEDANCE, JUNCTION TO CASE

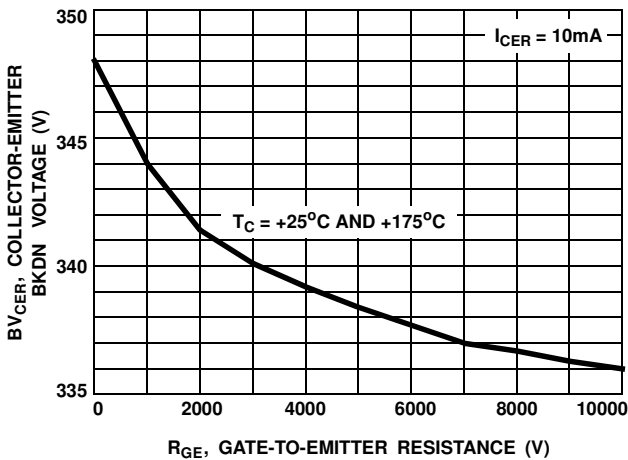


FIGURE 17. BREAKDOWN VOLTAGE AS A FUNCTION OF GATE - EMITTER RESISTANCE

Test Circuits

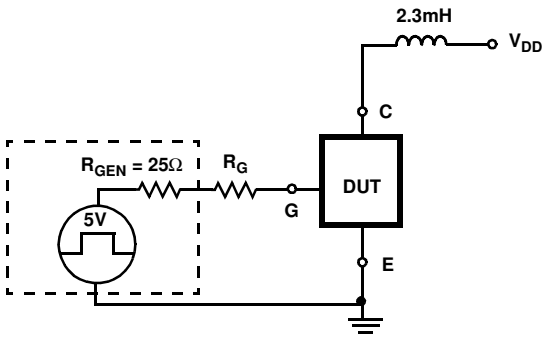


FIGURE 18. USE TEST CIRCUIT

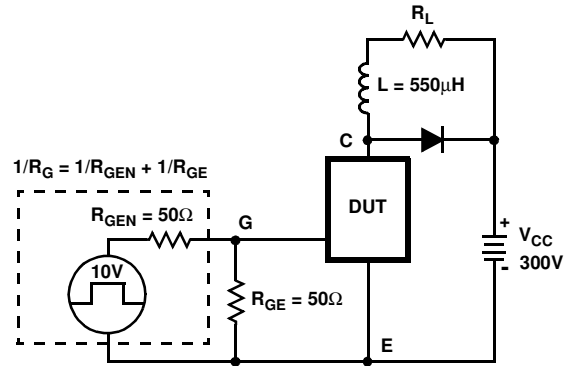


FIGURE 19. INDUCTIVE SWITCHING TEST CIRCUIT

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