FAIRCHILD SEMICONDUCTOR®

HGTP20N35G3VL, HGT1S20N35G3VL, HGT1S20N35G3VLS

20A, 350V N-Channel, Logic Level, Voltage Clamping IGBTs

December 2001

Features

- **Logic Level Gate Drive**
- **Internal Voltage Clamp**
- **ESD Gate Protection**
- **T_J = 175°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

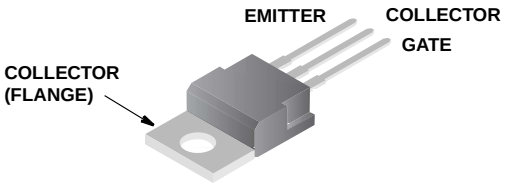
PART NUMBER	PACKAGE	BRAND
HGTP20N35G3VL	T0-220AB	20N35GVL
HGT1S20N35G3VL	T0-262AA	20N35GVL
HGT1S20N35G3VLS	T0-263AB	20N35GVL

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.

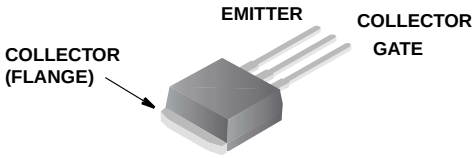
The development type number for this device is TA49076.

Packages

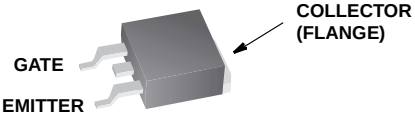
JEDEC TO-220AB



JEDEC TO-262AA

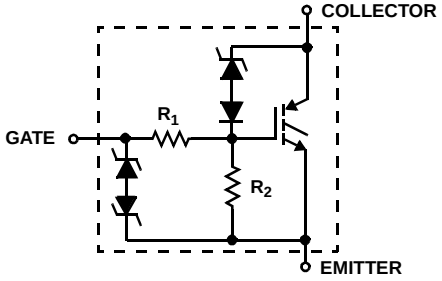


JEDEC TO-263AB



Terminal Diagram

N-CHANNEL ENHANCEMENT MODE



Absolute Maximum Ratings T_C = +25°C, Unless Otherwise Specified

		HGTP20N35G3VL HGT1S20N35G3VL HGT1S20N35G3VLS	UNITS
Collector-Emitter Bkdn Voltage At 10mA, R_{GE} = 1kΩ	BV_{CER}	375	V
Emitter-Collector Bkdn Voltage At 10mA	BV_{ECS}	24	V
Collector Current Continuous At V_{GE} = 5.0V, T_C = +25°C, Figure 7	I_{C25}	20	A
At V_{GE} = 5.0V, T_C = +100°C	I_{C100}	20	A
Gate-Emitter-Voltage (Note)	V_{GES}	±10	V
Inductive Switching Current At L = 2.3mH, T_C = +25° C	I_{SCIS}	26	A
At L = 2.3mH, T C = +175°C	I_{SCIS}	18	A
Collector to Emitter Avalanche Energy At L = 2.3mH, T_C = +25°C	E_{AS}	775	mJ
Power Dissipation Total At T_C = +25°C	P_D	150	W
Power Dissipation Derating T_C > +25°C		1.0	W/°C
Operating and Storage Junction Temperature Range	T_J, T_{STG}	-40 to +175	°C
Maximum Lead Temperature for Soldering	T_L	260	°C
Electrostatic Voltage at 100pF, 1500Ω	ESD	6	KV

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

Electrical Specifications $T_C = +25^oC$, Unless Otherwise Specified

PARAMETERS	SYMBOL	TEST CONDITIONS		LIMITS MIN	LIMITS TYP	LIMITS MAX	UNITS
Collector-Emitter Breakdown Voltage	BV_{CES}	I_C = 10mA, V_{GE} = 0V	$T_C = +175^oC$	310	345	380	V
			$T_C = +25^oC$	320	350	380	V
			$T_C = -40^oC$	320	355	390	V
Collector-Emitter Breakdown Voltage	BV_{CER}	I_C = 10mA, V_{GE} = 0V, R_{GE} = 1kΩ	$T_C = +175^oC$	300	340	375	V
			$T_C = +25^oC$	315	345	375	V
			$T_C = -40^oC$	315	350	390	V
Gate-Emitter Plateau Voltage	V_{GEP}	I_C = 10A, V_{CE} = 12V	$T_C = +25^oC$	-	3.7	-	V
Gate Charge	$Q_{G(ON)}$	I_C = 10A, V_{GE} = 5V, V_{CE} = 12V	$T_C = +25^oC$	-	28.7	-	nC
Collector-Emitter Clamp Bkdn. Voltage	$BV_{CE(CL)}$	I_C = 10A, R_G = 0Ω	$T_C = +175^oC$	325	360	395	V
Emitter-Collector Breakdown Voltage	BV_{ECS}	I_C = 10mA	$T_C = +25^oC$	20	32	-	V
Collector-Emitter Leakage Current	I_{CES}	V_{CE} = 250V	$T_C = +25^oC$	-	-	5	μA
		V_{CE} = 250V	$T_C = +175^oC$	-	-	250	μA
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	I_C = 10A, V_{GE} = 4.5V	$T_C = +25^oC$	-	1.3	1.6	V
			$T_C = +175^oC$	-	1.25	1.5	V
		I_C = 20A, V_{GE} = 5.0V	$T_C = +25^oC$	-	1.6	2.8	V
			$T_C = +175^oC$	-	1.9	3.5	V
Gate-Emitter Threshold Voltage	$V_{GE(TH)}$	I_C = 1mA, V_{CE} = V_{GE}	$T_C = +25^oC$	1.3	1.8	2.3	V
Gate Series Resistance	R_1		$T_C = +25^oC$	-	1.0	-	kΩ
Gate-Emitter Resistance	R_2		$T_C = +25^oC$	10	17	25	kΩ
Gate-Emitter Leakage Current	I_{GES}	V_{GE} = ±10V		±400	±590	±1000	μA
Gate-Emitter Breakdown Voltage	BV_{GES}	I_{GES} = ±2mA		±12	±14	-	V
Current Turn-Off Time-Inductive Load	$t_{D(OFF)I}$ + $t_{F(OFF)I}$	I_C = 10A, R_G = 25Ω, L = 550μH, R_L = 26.4Ω, V_{GE} = 5V, V_{CL} = 300V, $T_C = +175^oC$		-	15	30	μs
Inductive Use Test	I_{SCIS}	L = 2.3mH, V_G = 5V, R_G = 0Ω	$T_C = +175^oC$	18	-	-	A
			$T_C = +25^oC$	26	-	-	A
Thermal Resistance	$R_{\theta JC}$			-	-	1.0	$^oC/W$

Typical Performance Curves

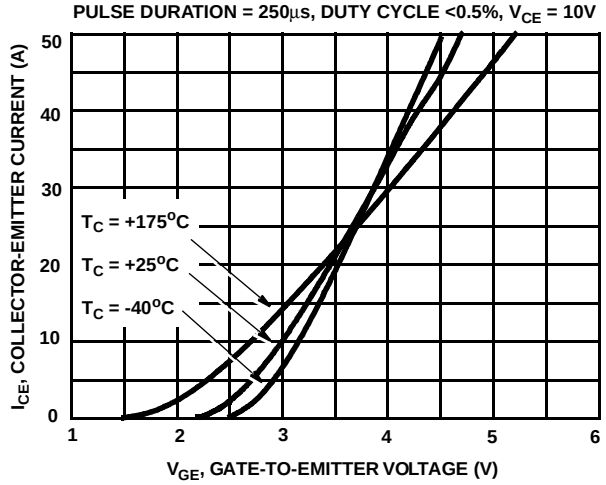


FIGURE 1. TRANSFER CHARACTERISTICS

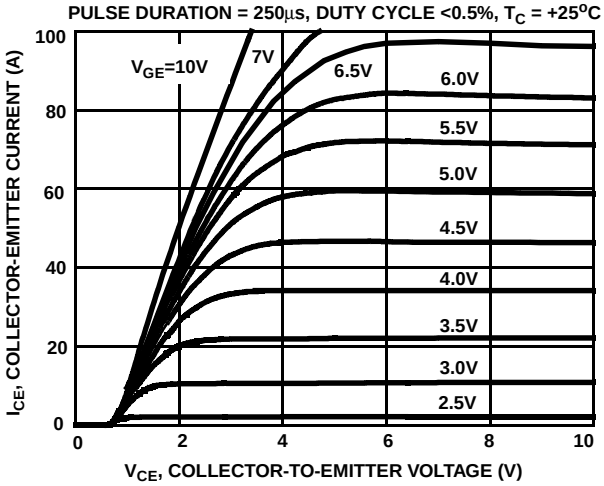


FIGURE 2. SATURATION CHARACTERISTICS

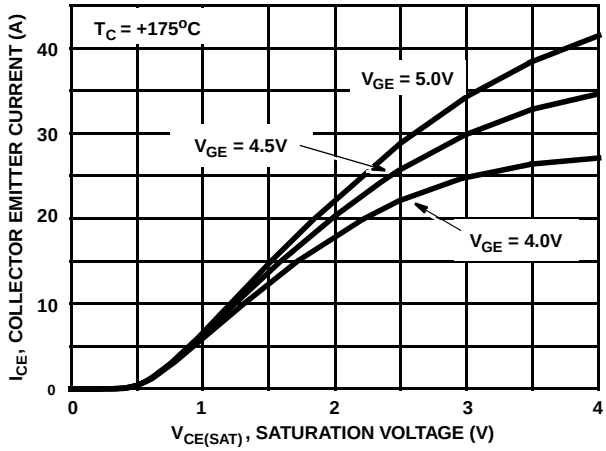


FIGURE 3. COLLECTOR-EMITTER CURRENT AS A FUNCTION OF SATURATION VOLTAGE

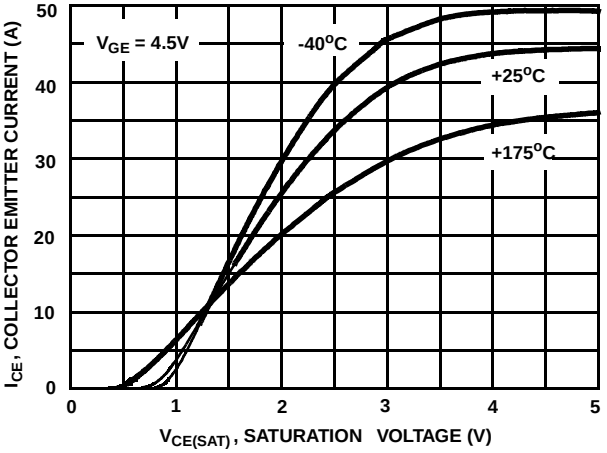


FIGURE 4. COLLECTOR-EMITTER CURRENT AS A FUNCTION OF SATURATION VOLTAGE

Typical Performance Curves (Continued)

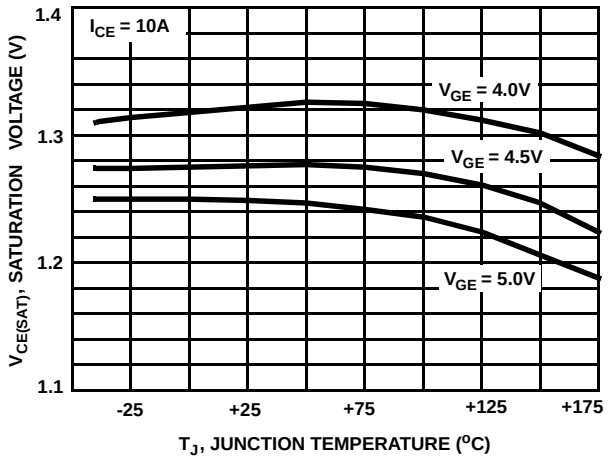


FIGURE 5. SATURATION VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE

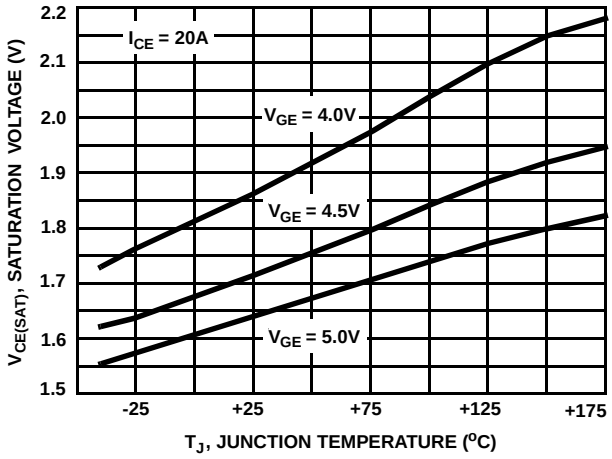


FIGURE 6. SATURATION VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE

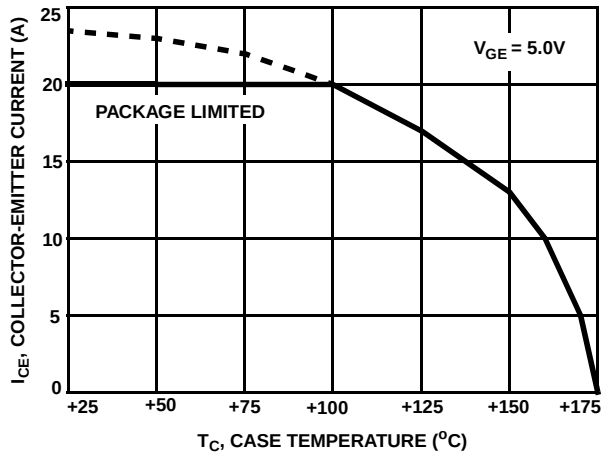


FIGURE 7. COLLECTOR-EMITTER CURRENT AS A FUNCTION OF CASE TEMPERATURE

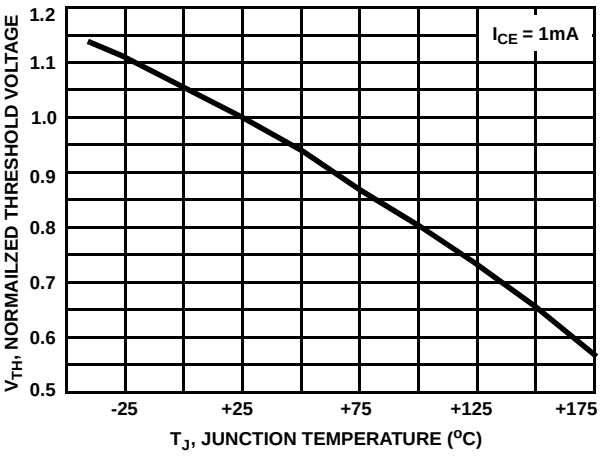


FIGURE 8. NORMALIZED THRESHOLD VOLTAGE AS A FUNCTION OF JUNCTION TEMPERATURE

Typical Performance Curves (Continued)

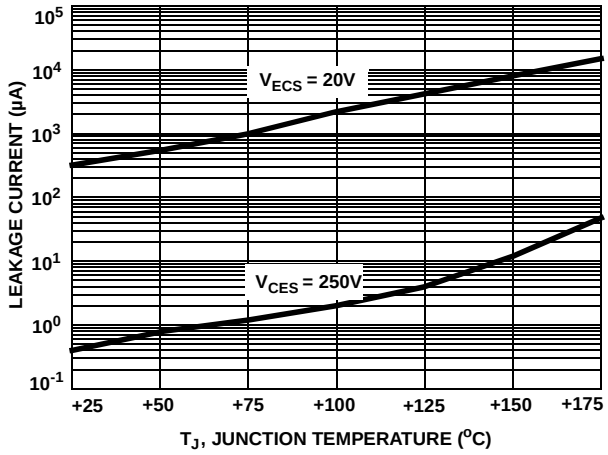


FIGURE 9. LEAKAGE CURRENT AS A FUNCTION OF JUNCTION TEMPERATURE

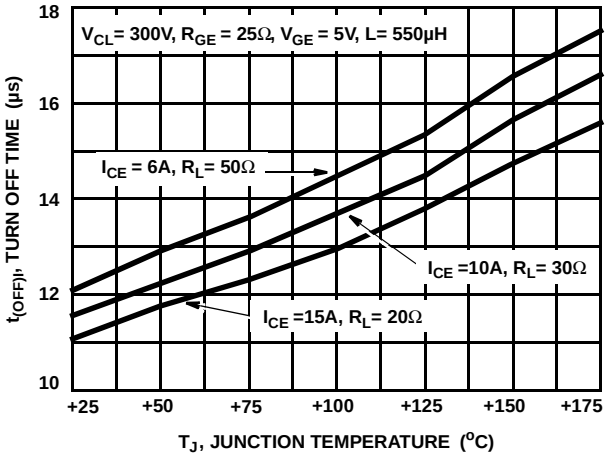


FIGURE 10. TURN-OFF TIME AS A FUNCTION OF JUNCTION TEMPERATURE

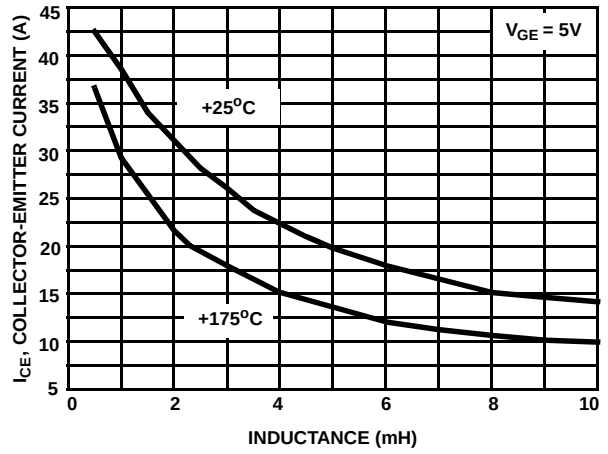


FIGURE 11. SELF CLAMPED INDUCTIVE SWITCHING CURRENT AS A FUNCTION OF INDUCTANCE

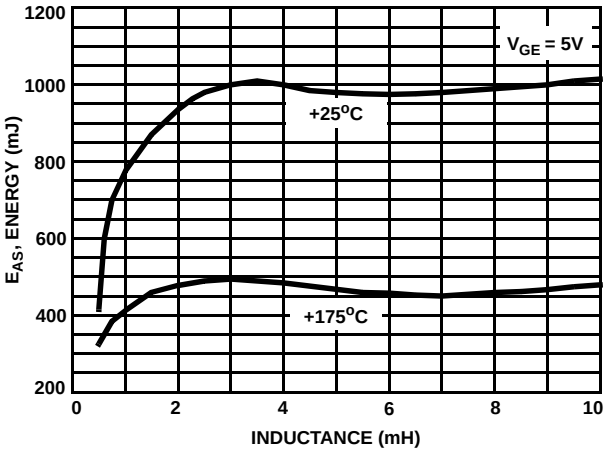


FIGURE 12. SELF CLAMPED INDUCTIVELY SWITCHING ENERGY AS A FUNCTION OF INDUCTANCE

Typical Performance Curves (Continued)

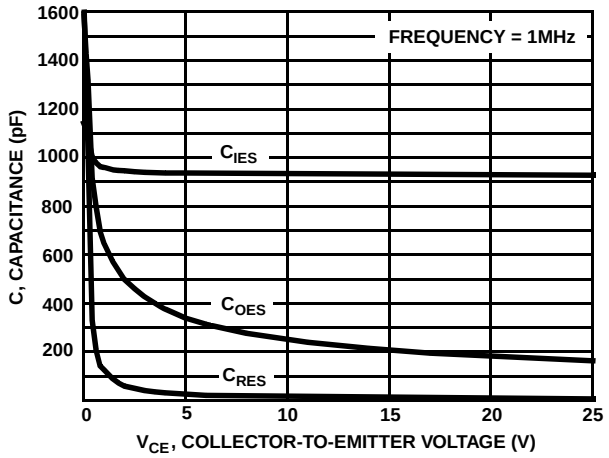


FIGURE 13. CAPACITANCE AS A FUNCTION OF COLLECTOR-EMITTER VOLTAGE

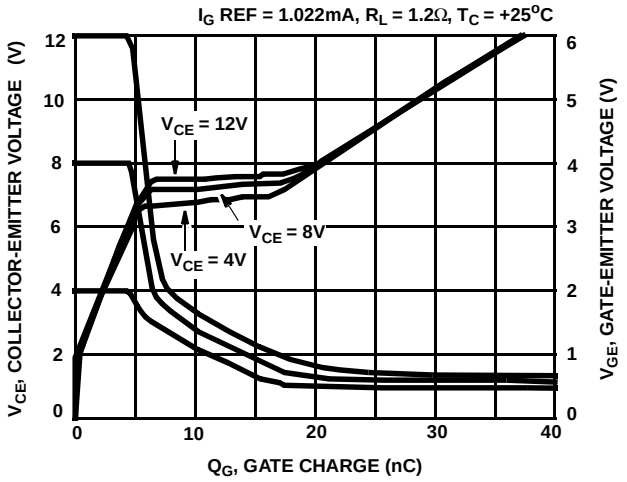


FIGURE 14. GATE CHARGE WAVEFORMS

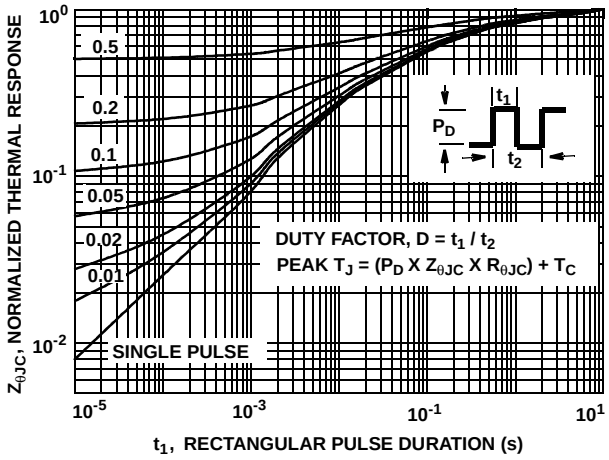


FIGURE 15. NORMALIZED TRANSIENT THERMAL IMPEDANCE, JUNCTION TO CASE

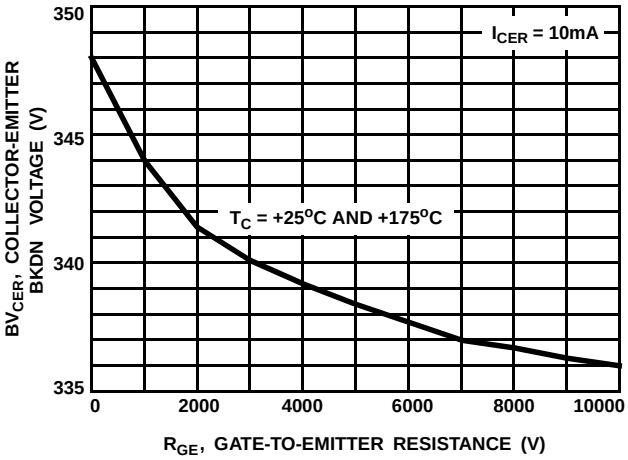


FIGURE 16. BREAKDOWN VOLTAGE AS A FUNCTION OF GATE - EMITTER RESISTANCE

Test Circuits

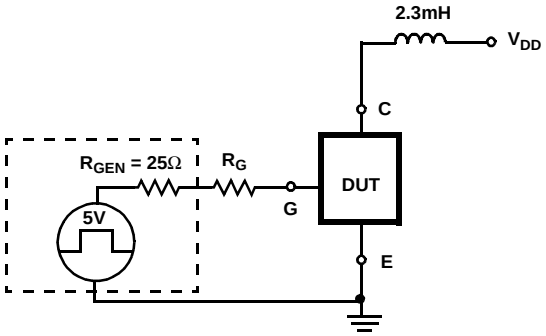


FIGURE 17. USE TEST CIRCUIT

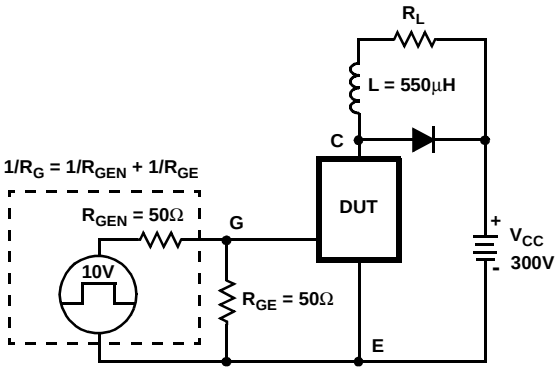


FIGURE 18. INDUCTIVE SWITCHING TEST CIRCUIT

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