FAIRCHILD SEMICONDUCTOR®

HGTP20N36G3VL,HGT1S20N36G3VLS, HGT1S20N36G3VL

20A, 360V N-Channel, Logic Level, Voltage Clamping IGBTs

March 2004

Features

- **Logic Level Gate Drive**
- **Internal Voltage Clamp**
- **ESD Gate Protection**
- **$T_J = 175^oC$**
- **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.

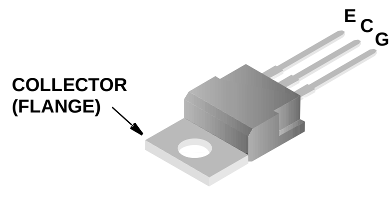
PACKAGING

PART NUMBER	PACKAGE	BRAND
HGTP20N36G3VL	TO-220AB	20N36GVL
HGT1S20N36G3VL	TO-262AA	20N36GVL
HGT1S20N36G3VLS	TO-263AB	20N36GVL

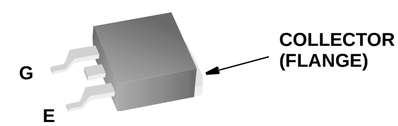
The development type number for this device is TA49296.

Packages

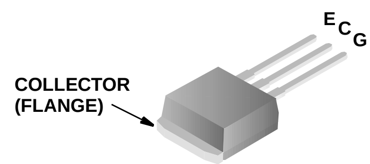
JEDEC TO-220AB



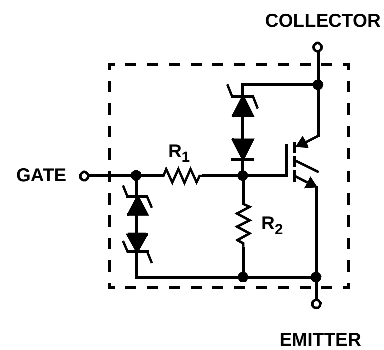
JEDEC TO-263AB



JEDEC TO-262AA



Symbol



Absolute Maximum Ratings $T_C = +25^oC$, Unless Otherwise Specified

		HGTP20N36G3VL HGT1S20N36G3VL HGT1S20N36G3VLS	UNITS
Collector-Emitter Bkdn Voltage At 10mA, $R_{GE} = 1k\Omega$	BV_{CER}	395	V
Emitter-Collector Bkdn Voltage At 10mA	BV_{ECS}	28	V
Collector Current Continuous At $V_{GE} = 5.0V$, $T_C = +25^oC$, Figure 7	I_{C25}	37.7	A
At $V_{GE} = 5.0V$, $T_C = +100^oC$	I_{C100}	26	A
Gate-Emitter-Voltage (Note)	V_{GES}	±10	V
Inductive Switching Current At L = 2.3mH, $T_C = +25^o$ C	I_{SCIS}	21	A
At L = 2.3mH, $T_C = +150^oC$	I_{SCIS}	16	A
Collector to Emitter Avalanche Energy At L = 2.3mH, $T_C = +25^oC$	E_{AS}	500	mJ
Power Dissipation Total At $T_C = +25^oC$	P_D	150	W
Power Dissipation Derating $T_C > +25^oC$		1.0	$W/^oC$
Operating and Storage Junction Temperature Range	T_J, T_{STG}	-40 to +175	^oC
Maximum Lead Temperature for Soldering	T_L	260	^oC
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			UNITS
				MIN	TYP	MAX	
Collector-Emitter Breakdown Voltage	BV_{CES}	$I_C = 10mA$, $V_{GE} = 0V$	$T_C = +175^oC$	345	380	415	V
			$T_C = +25^oC$	355	385	415	V
			$T_C = -40^oC$	355	390	425	V
Collector-Emitter Breakdown Voltage	BV_{CER}	$I_C = 10mA$ $V_{GE} = 0V$ $R_{GE} = 1k\Omega$	$T_C = +175^oC$	320	360	395	V
			$T_C = +25^oC$	335	365	395	V
			$T_C = -40^oC$	335	370	410	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 Breakdown Voltage	$BV_{CE(CL)}$	$I_C = 10A$ $R_G = 1K\Omega$	$T_C = +175^oC$	330	360	415	V
Emitter-Collector Breakdown Voltage	BV_{ECS}	$I_C = 10mA$	$T_C = +25^oC$	28	36	-	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
Emitter-Collector Leakage Current	I_{ECS}	$V_{EC} = 24V$	$T_C = +25^oC$	-	-	1.0	mA
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	1.9	V
			$T_C = +175^oC$	-	1.9	2.4	V
Gate-Emitter Threshold Voltage	$V_{GE(TH)}$	$I_C = 1mA$ $V_{CE} = V_{GE}$	$T_C = +25^oC$	1.1	1.6	2.3	V
Gate Series Resistance	R_1		$T_C = +25^oC$	-	75	-	Ω
Gate-Emitter Resistance	R_2		$T_C = +25^oC$	10	20	30	kΩ
Gate-Emitter Leakage Current	I_{GES}	$V_{GE} = \pm10V$		±330	±500	±1000	μA
Gate-Emitter Breakdown Voltage	BV_{GES}	$I_{GES} = \pm2mA$		±12	±14	-	V
Current Turn-Off Time-Inductive Load	$t_{D(OFF)I}$ + $t_{F(OFF)I}$	$I_C = 10A$, $R_G = 25\Omega$, $L = 550\mu H$, $R_L = 26.4\Omega$, $V_{GE} = 5V$, $V_{CL} = 300V$, $T_C = +175^oC$		-	15	30	μs
Inductive Use Test	I_{SCIS}	$L = 2.3mH$, $V_G = 5V$, $R_G = 1K\Omega$	$T_C = +150^oC$	16	-	-	A
			$T_C = +25^oC$	21	-	-	A
Thermal Resistance	$R_{\theta JC}$			-	-	1.0	$^oC/W$

Typical Performance Curves

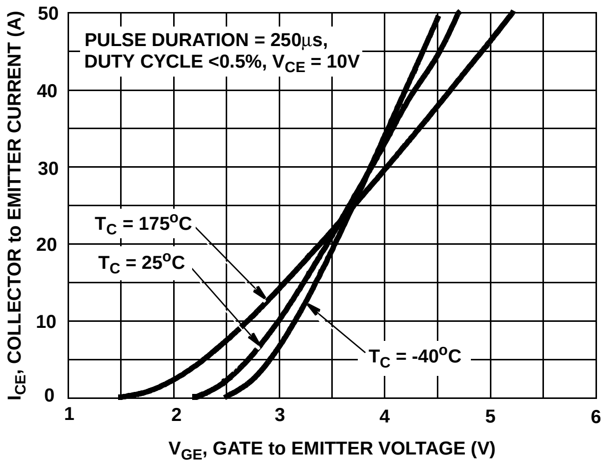


FIGURE 1. TRANSFER CHARACTERISTICS

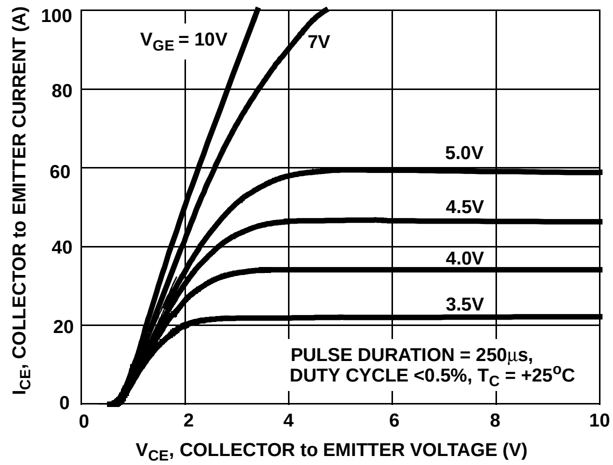


FIGURE 2. SATURATION CHARACTERISTICS

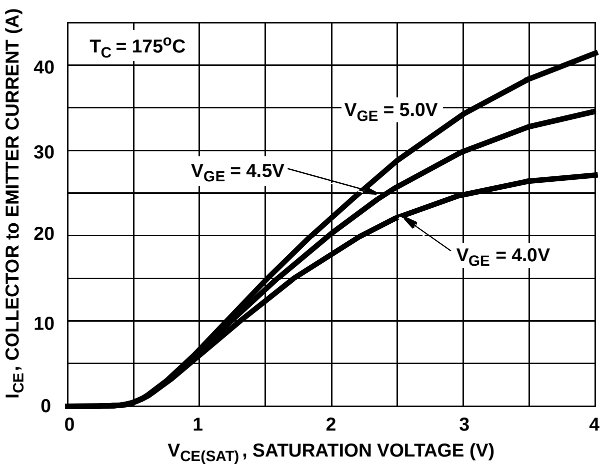


FIGURE 3. COLLECTOR to EMITTER CURRENT vs SATURATION VOLTAGE

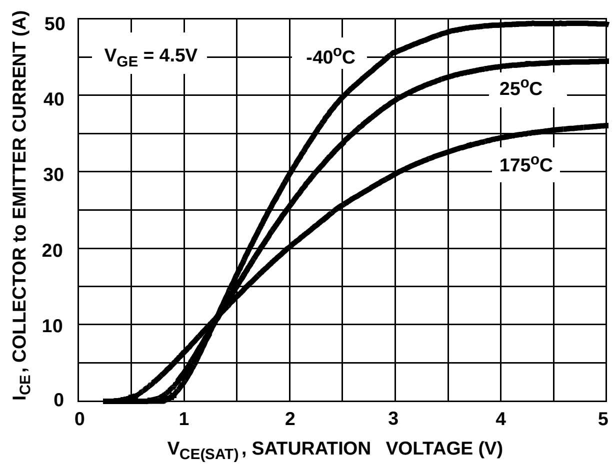


FIGURE 4. COLLECTOR to EMITTER CURRENT vs SATURATION VOLTAGE

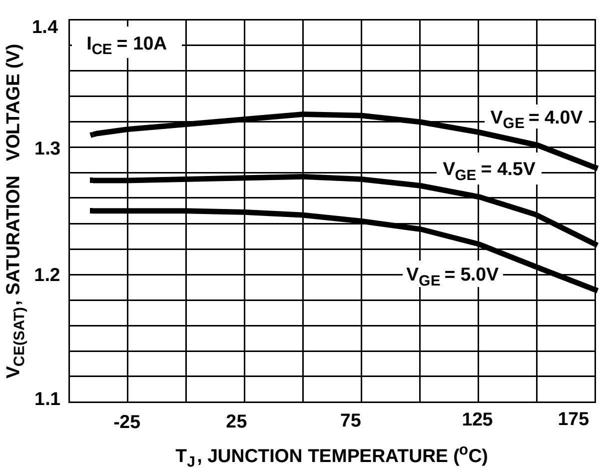


FIGURE 5. SATURATION VOLTAGE vs JUNCTION TEMPERATURE

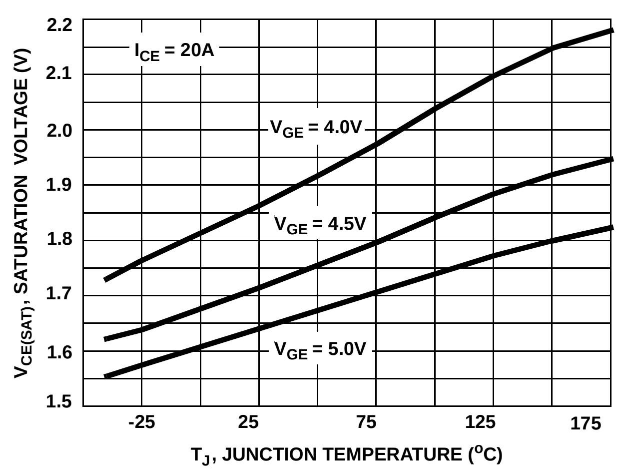


FIGURE 6. SATURATION VOLTAGE vs JUNCTION TEMPERATURE

Typical Performance Curves (Continued)

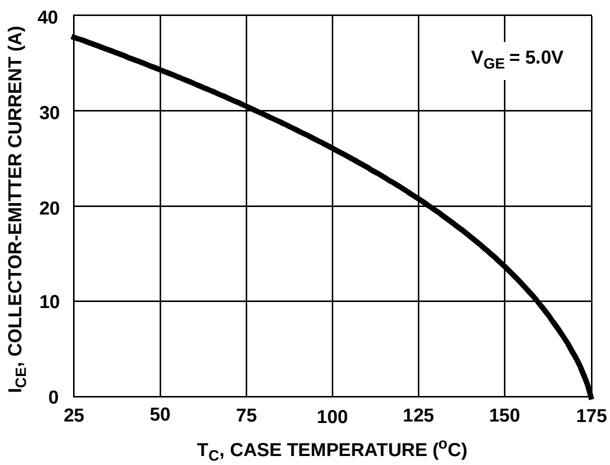


FIGURE 7. COLLECTOR-EMITTER CURRENT vs CASE TEMPERATURE

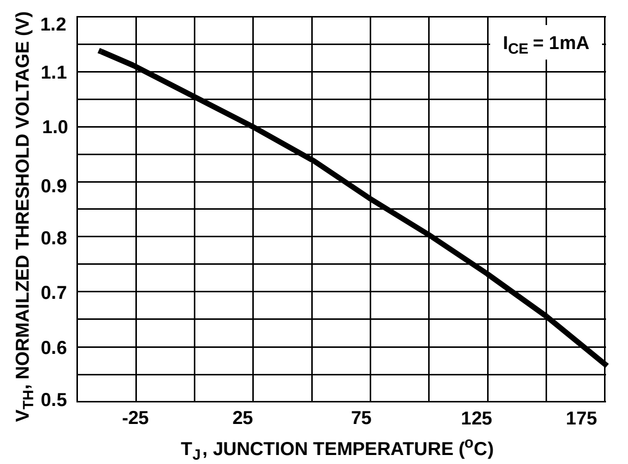


FIGURE 8. NORMALIZED THRESHOLD VOLTAGE vs JUNCTION TEMPERATURE

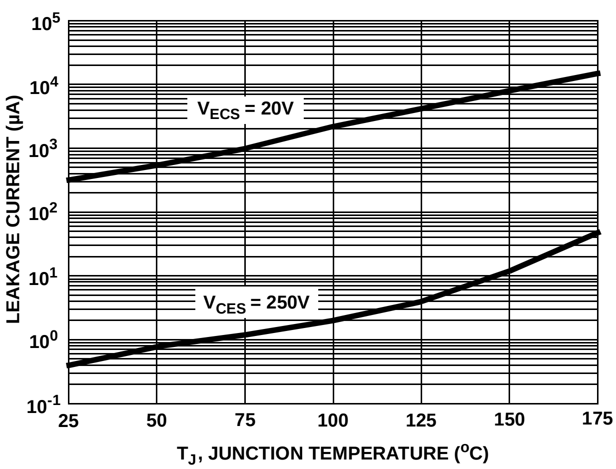


FIGURE 9. LEAKAGE CURRENT vs JUNCTION TEMPERATURE

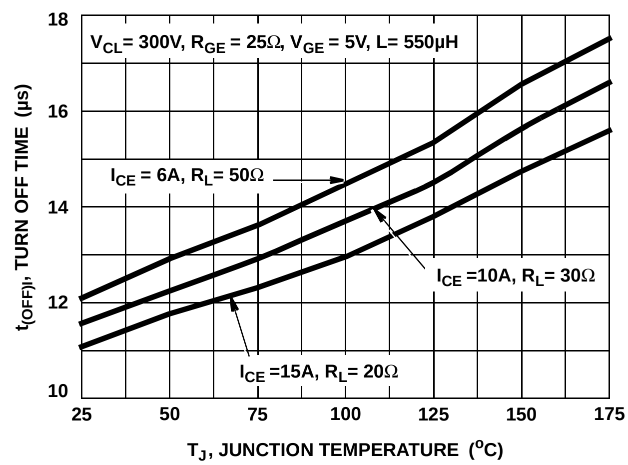


FIGURE 10. TURN-OFF TIME vs JUNCTION TEMPERATURE

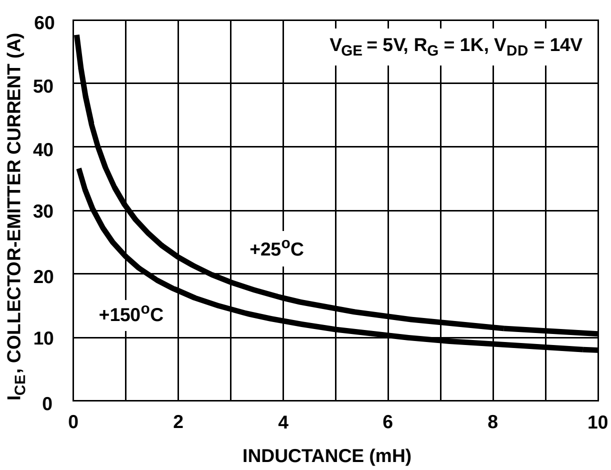


FIGURE 11. SELF CLAMPED INDUCTIVE SWITCHING CURRENT vs INDUCTANCE

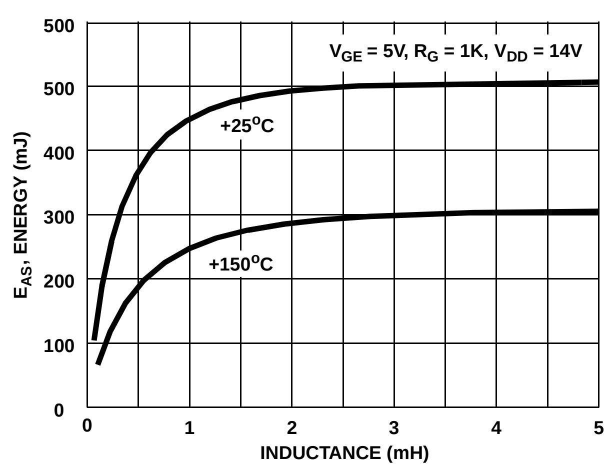


FIGURE 12. SELF CLAMPED INDUCTIVE SWITCHING ENERGY vs INDUCTANCE

Typical Performance Curves (Continued)

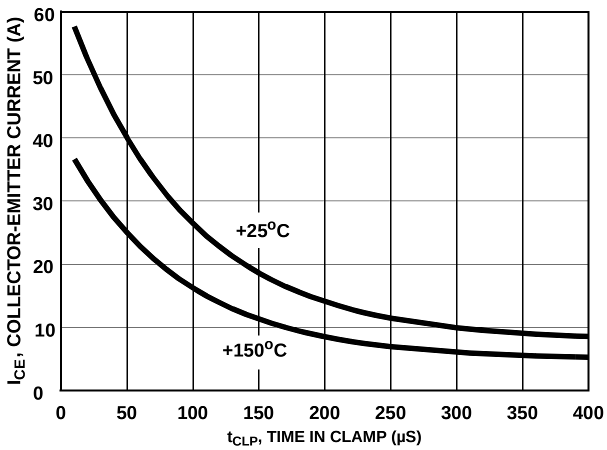


FIGURE 13. SELF CLAMPED INDUCTIVE SWITCHING CURRENT vs TIME IN CLAMP

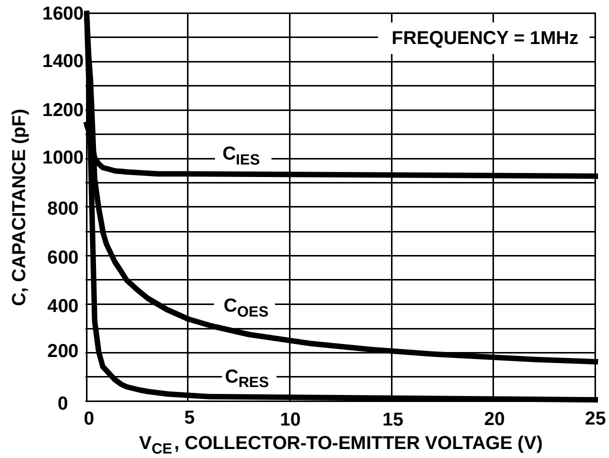


FIGURE 14. CAPACITANCE vs COLLECTOR-EMITTER VOLTAGE

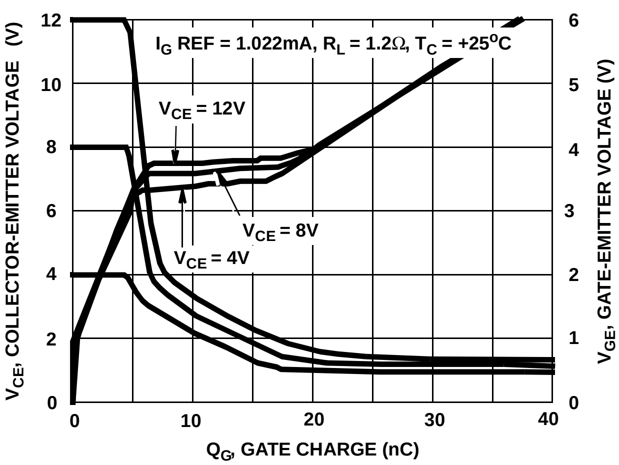


FIGURE 13. GATE CHARGE

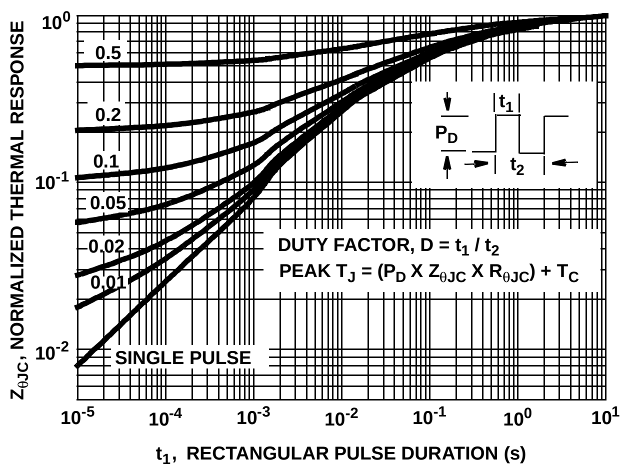


FIGURE 14. NORMALIZED TRANSIENT THERMAL IMPEDANCE, JUNCTION TO CASE

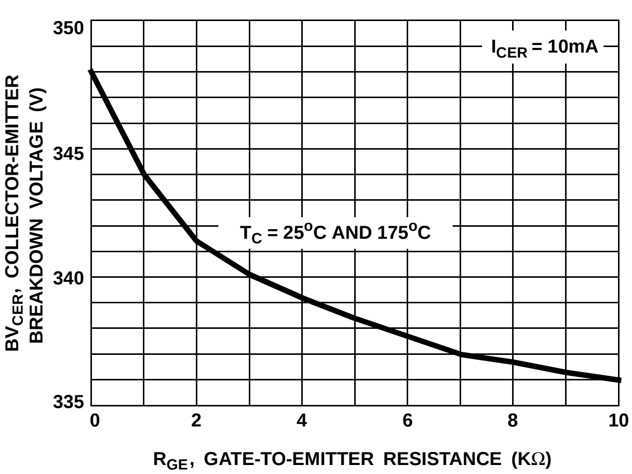


FIGURE 15.BREAKDOWN VOLTAGE vs GATE - EMITTER RESISTANCE

Test Circuits

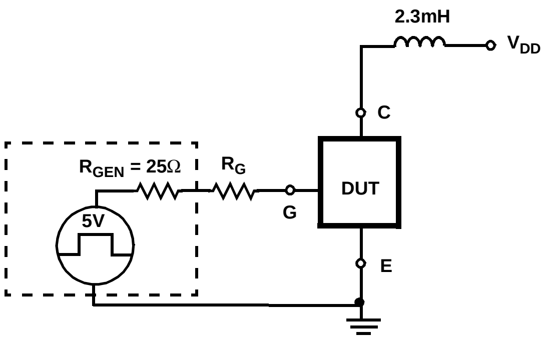


FIGURE 16. USE TEST CIRCUIT

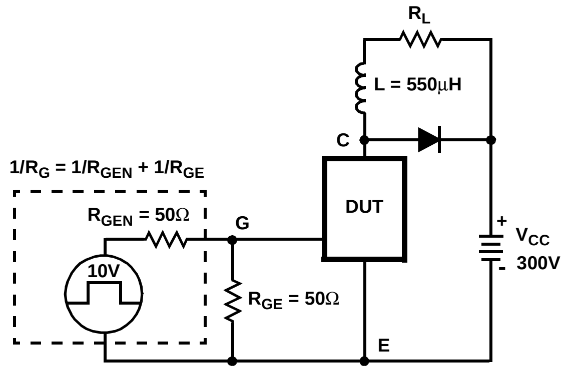


FIGURE 17. INDUCTIVE SWITCHING TEST CIRCUIT

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