FAIRCHILD

SEMICONDUCTOR®

FGD3440G2_F085

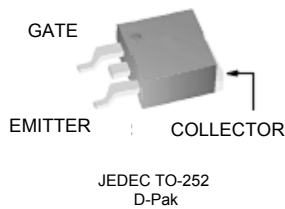## EcoSPARK®2 335mJ, 400V, N-Channel Ignition IGBT

Features

■ SCIS Energy = 335mJ at T_J = 25°C

■ Logic Level Gate Drive

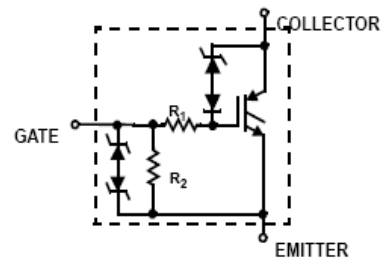■ Qualified to AEC Q101

■ RoHS Compliant

Applications

■ Automotive Ignition Coil Driver Circuits

■ Coil On Plug Applications

100% RoHS COMPLIANT

Package

GATE

EMITTER   COLLECTOR

JEDEC TO-252
D-Pak

Symbol

COLLECTOR

GATE

R_1

R_2

EMITTER

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Device Maximum Ratings T_A = 25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
BV_{CER}	Collector to Emitter Breakdown Voltage (I_C = 1mA)	400	V
BV_{ECS}	Emitter to Collector Voltage - Reverse Battery Condition (I_C = 10mA)	28	V
E_{SCIS25}	Self Clamping Inductive Switching Energy (Note 1)	335	mJ
$E_{SCIS150}$	Self Clamping Inductive Switching Energy (Note 2)	195	mJ
I_{C25}	Collector Current Continuous, at V_{GE} = 4.0V, T_C = 25°C	26.9	A
I_{C110}	Collector Current Continuous, at V_{GE} = 4.0V, T_C = 110°C	25	A
V_{GEM}	Gate to Emitter Voltage Continuous	±10	V
P_D	Power Dissipation Total, at T_C = 25°C	166	W
	Power Dissipation Derating, for T_C > 25°C	1.1	W/°C
T_J	Operating Junction Temperature Range	-40 to +175	°C
T_{STG}	Storage Junction Temperature Range	-40 to +175	°C
T_L	Max. Lead Temp. for Soldering (Leads at 1.6mm from case for 10s)	300	°C
T_{PKG}	Max. Lead Temp. for Soldering (Package Body for 10s)	260	°C
ESD	Electrostatic Discharge Voltage at100pF, 1500Ω	4	kV

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGD3440G2	FGD3440G2_F085	TO252	330mm	16mm	2500 units

Electrical Characteristics T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units

Off State Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
BV_{CER}	Collector to Emitter Breakdown Voltage	I_{CE} = 2mA, V_{GE} = 0, R_{GE} = 1KΩ, T_J = -40 to 150°C		370	400	430	V
BV_{CES}	Collector to Emitter Breakdown Voltage	I_{CE} = 10mA, V_{GE} = 0V, R_{GE} = 0, T_J = -40 to 150°C		390	420	450	V
BV_{ECS}	Emitter to Collector Breakdown Voltage	I_{CE} = -20mA, V_{GE} = 0V, T_J = 25°C		28	-	-	V
BV_{GES}	Gate to Emitter Breakdown Voltage	I_{GES} = ±2mA		±12	±14	-	V
I_{CER}	Collector to Emitter Leakage Current	V_{CE} = 250V, R_{GE}=1KΩ	T_J = 25°C	-	-	25	µA
			T_J = 150°C	-	-	1	mA
I_{ECS}	Emitter to Collector Leakage Current	V_{EC} = 24V,	T_J = 25°C	-	-	1	mA
			T_J = 150°C	-	-	40	
R_1	Series Gate Resistance			-	120	-	Ω
R_2	Gate to Emitter Resistance			10K	-	30K	Ω

On State Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	I_{CE} = 6A, V_{GE} = 4V,	T_J = 25°C	-	1.1	1.2	V
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	I_{CE} = 10A, V_{GE} = 4.5V,	T_J = 150°C	-	1.3	1.45	V
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	I_{CE} = 15A, V_{GE} = 4.5V,	T_J = 150°C	-	1.6	1.75	V
E_{SCIS}	Self Clamped Inductive Switching	L = 3.0 mHy, V_{GE} = 5V R_G = 1KΩ, (Note 1)	T_J = 25°C	-	-	335	mJ

Electrical Characteristics T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
Dynamic Characteristics							
$Q_{G(ON)}$	Gate Charge	I_{CE} = 10A, V_{CE} = 12V, V_{GE} = 5V		-	24	-	nC
$V_{GE(TH)}$	Gate to Emitter Threshold Voltage	I_{CE} = 1mA, V_{CE} = V_{GE},	T_J = 25°C	1.3	1.7	2.2	V
			T_J = 150°C	0.75	1.2	1.8	
V_{GEP}	Gate to Emitter Plateau Voltage	V_{CE} = 12V, I_{CE} = 10A		-	2.8	-	V
Switching Characteristics							
$t_{d(ON)R}$	Current Turn-On Delay Time-Resistive	V_{CE} = 14V, R_L = 1Ω		-	1.0	4	µs
t_{rR}	Current Rise Time-Resistive	V_{GE} = 5V, R_G = 1KΩ T_J = 25°C,		-	2.0	7	µs
$t_{d(OFF)L}$	Current Turn-Off Delay Time-Inductive	V_{CE} = 300V, L = 1mH,		-	5.3	15	µs
t_{fL}	Current Fall Time-Inductive	V_{GE} = 5V, R_G = 1KΩ I_{CE} =6.5A, T_J = 25°C,		-	2.3	15	µs
Thermal Characteristics							
$R_{\theta JC}$	Thermal Resistance Junction to Case			-	-	0.9	°C/W

Notes:

1: Self Clamping Inductive Switching Energy(E_{SCIS25}) of 335mJ is based on the test conditions that is starting T_J=25 °C; L=3mHy, I_{SCIS}=15A,V_{CC}=100V during inductor charging and V_{CC}=0V during the time in clamp .

2: Self Clamping Inductive Switching Energy ($E_{SCIS150}$) of 195mJ is based on the test conditions that is starting T_J=150 °C; L=3mHy, I_{SCIS}=11.4A,V_{CC}=100V during inductor charging and V_{CC}=0V during the time in clamp.

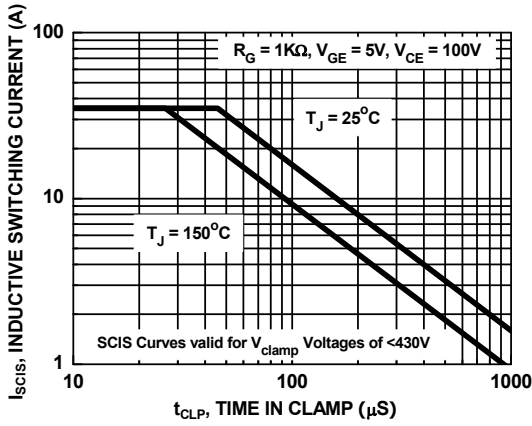# Typical Performance Curves

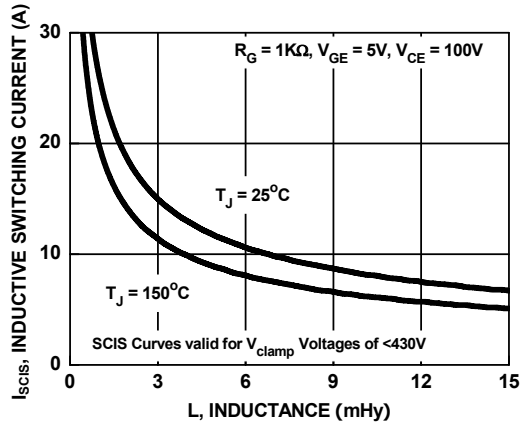**Figure 1. Self Clamped Inductive Switching Current vs. Time in Clamp**

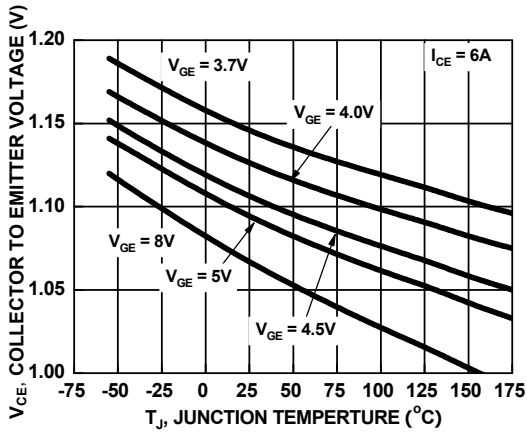**Figure 2. Self Clamped Inductive Switching Current vs. Inductance**

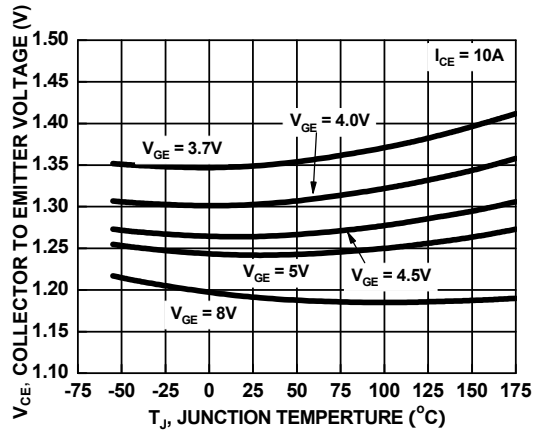**Figure 3. Collector to Emitter On-State Voltage vs. Junction Temperature**

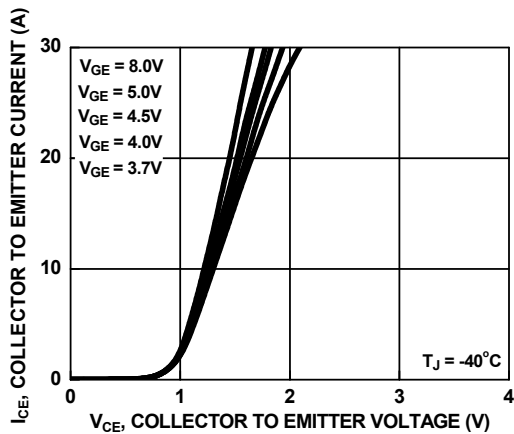**Figure 4. Collector to Emitter On-State Voltage vs. Junction Temperature**

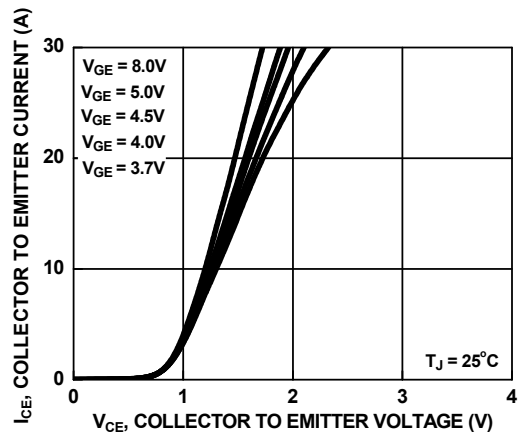**Figure 5. Collector to Emitter On-State Voltage vs. Collector Current**

Figure 6. Collector to Emitter On-State Voltage vs. Collector Current

Typical Performance Curves   (Continued)
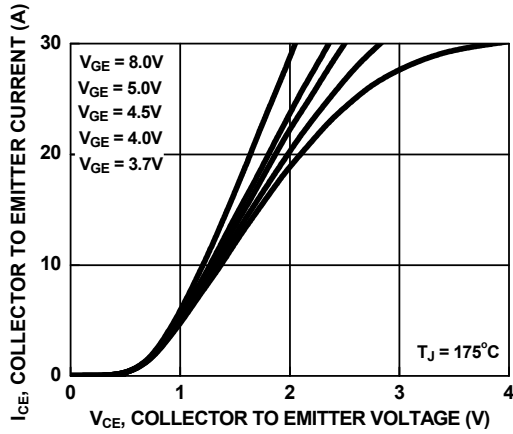
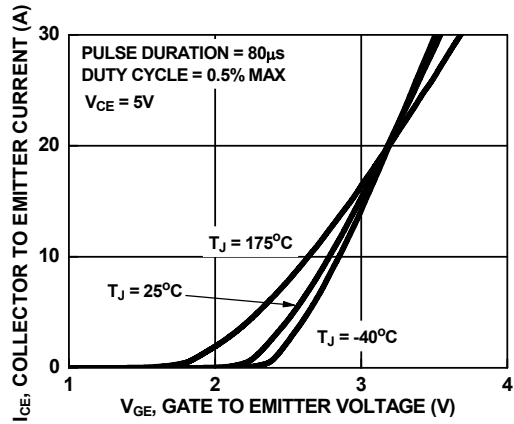**Figure 7. Collector to Emitter On-State Voltage vs. Collector Current**
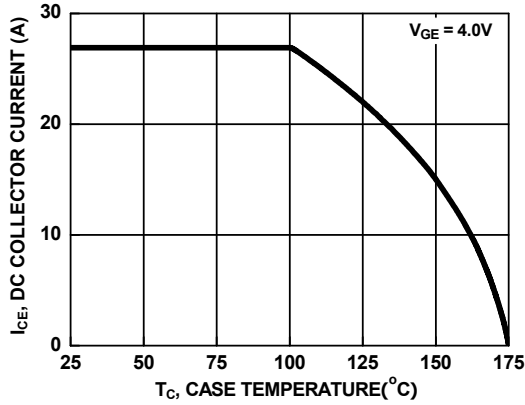
Figure 8. Transfer Characteristics

Figure 9. DC Collector Current vs. Case Temperature
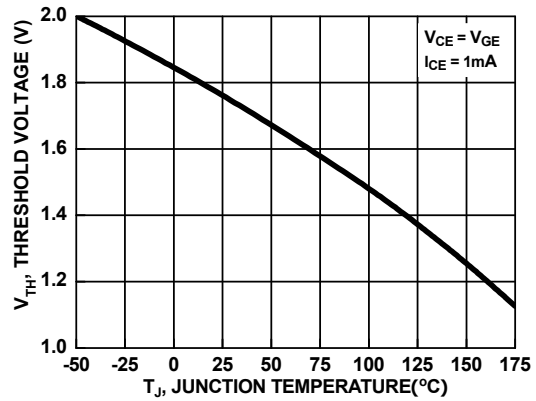
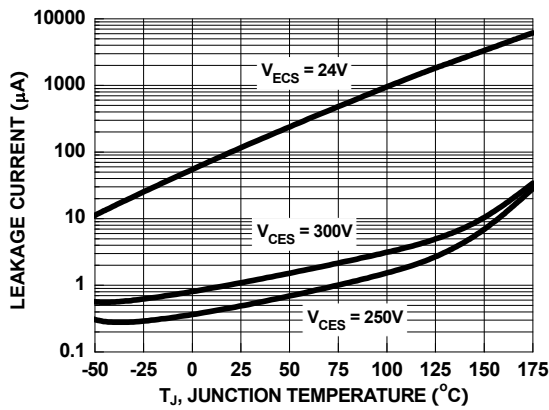**Figure 10. Threshold Voltage vs. Junction Temperature**

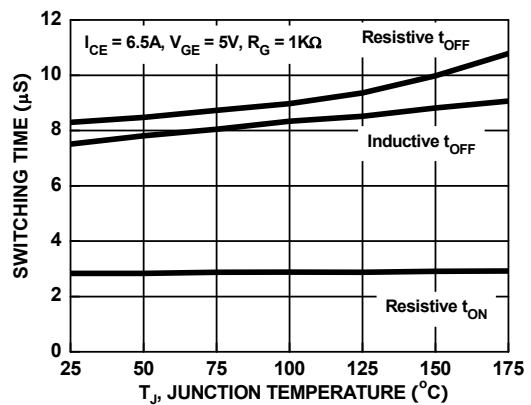**Figure 11. Leakage Current vs. Junction Temperature**

Figure 12. Switching Time vs. Junction Temperature

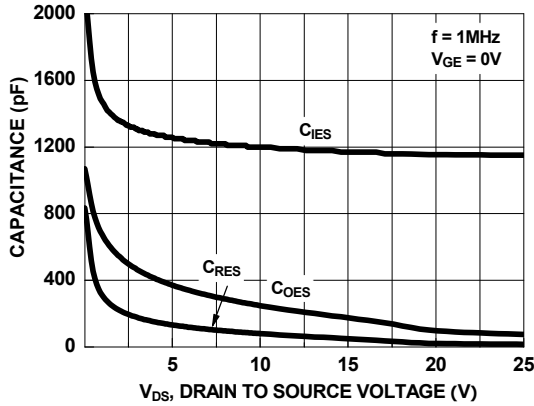## Typical Performance Curves   (Continued)

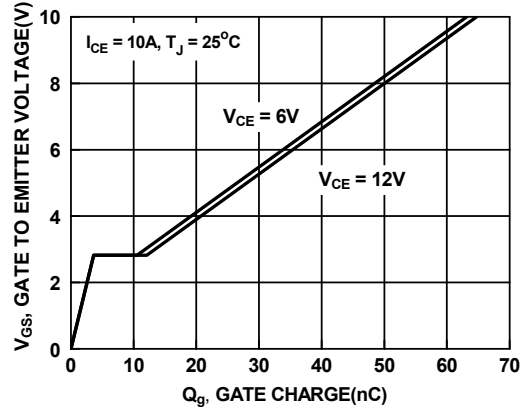**Figure 13. Capacitance vs. Collector to Emitter Voltage**

Figure 14. Gate Charge
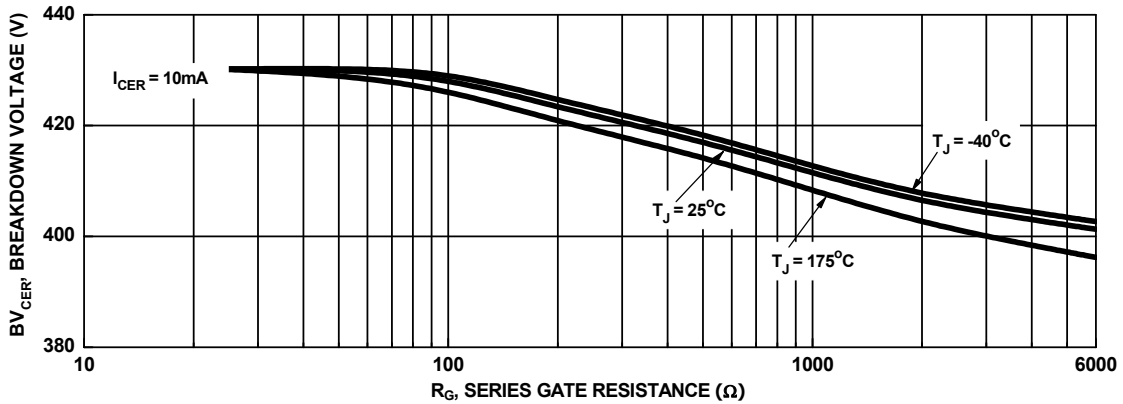

Figure 15. Break down Voltage vs. Series Gate Resistance

NOTES:
DUTY FACTOR: D = t_1/t_2
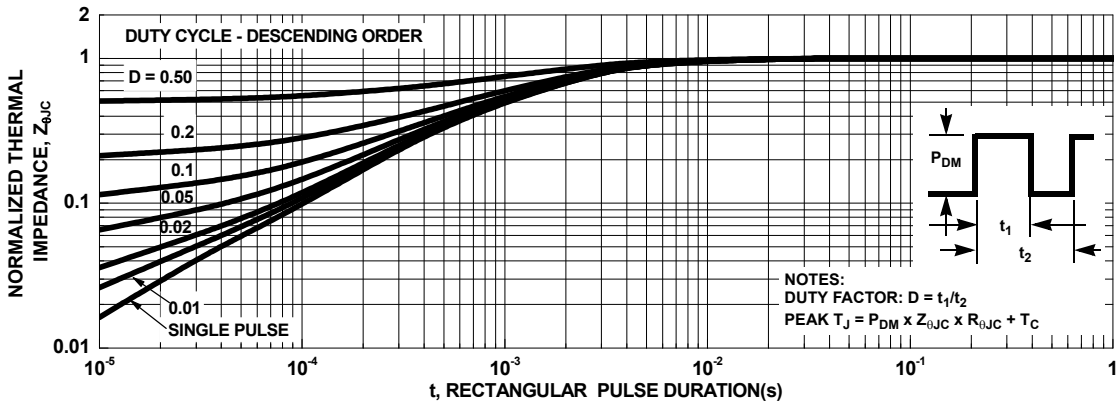PEAK T_J = P_{DM} x $Z_{\theta JC}$ x $R_{\theta JC}$ + T_C

Figure 16. IGBT Normalized Transient Thermal Impedance, Junction to Case

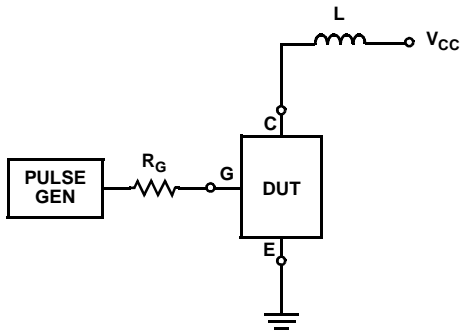## Test Circuit and Waveforms

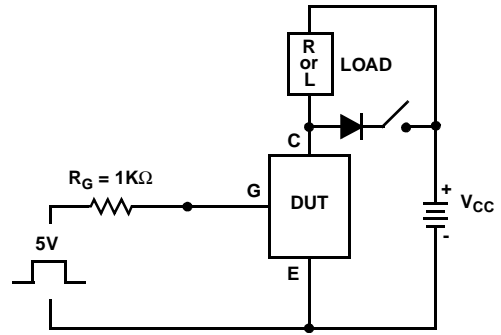**Figure 17. Inductive Switching Test Circuit**

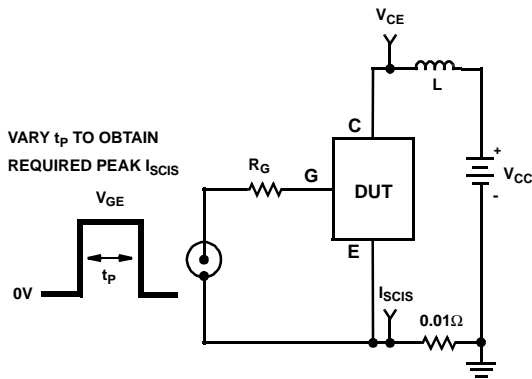**Figure 18. t_{ON} and t_{OFF} Switching Test Circuit**
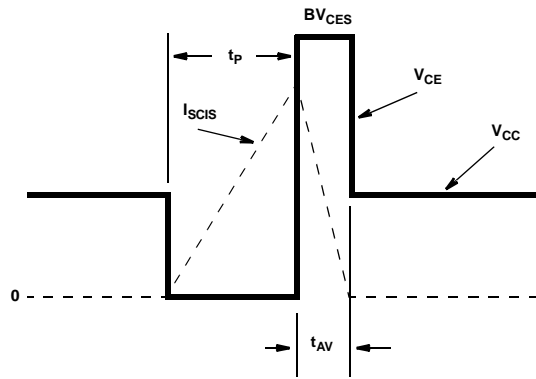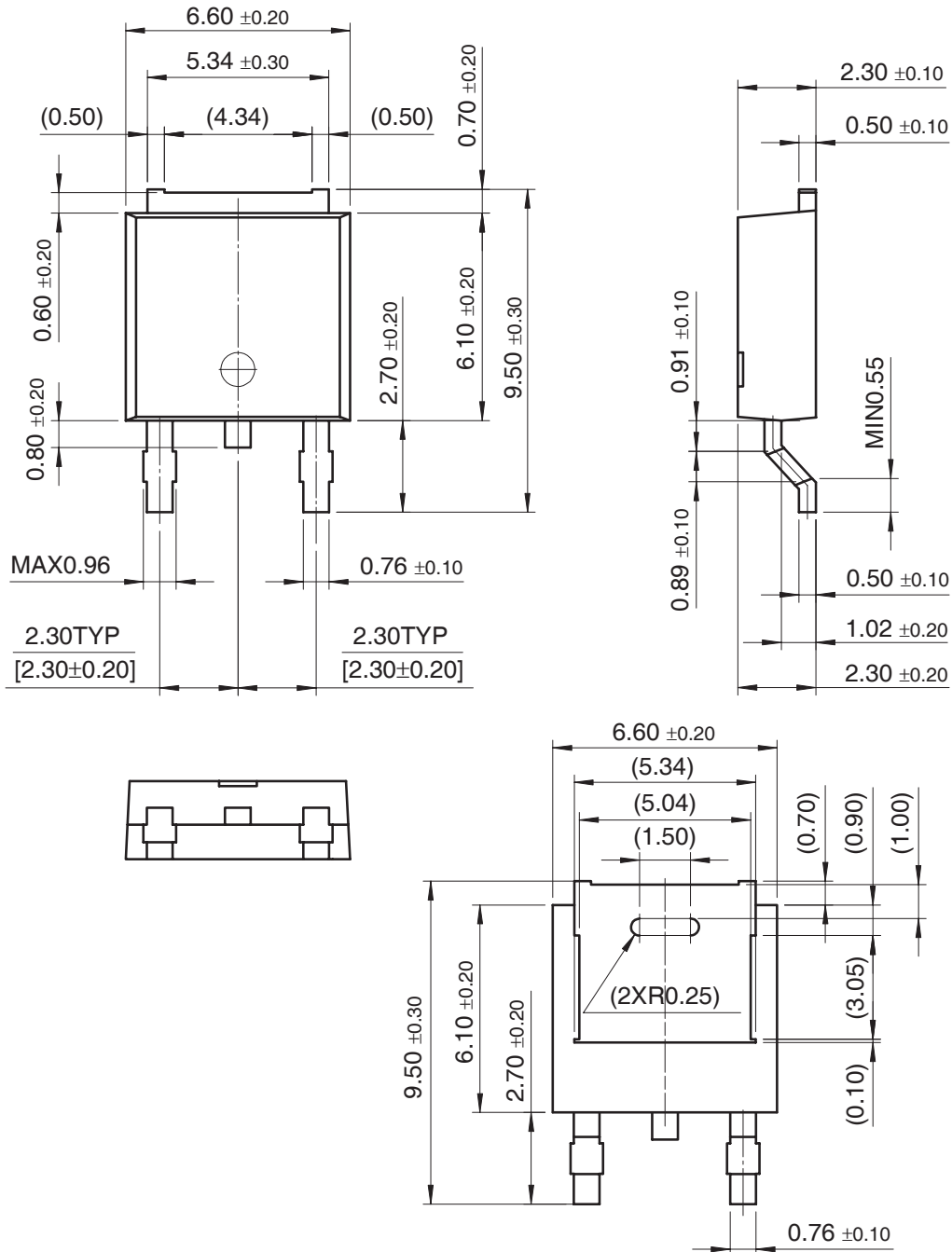

Figure 19. Energy Test Circuit

Figure 20. Energy Waveforms

Mechanical Dimensions

D-PAK

Dimensions in Millimeters

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