

1N60HA-VB Datasheet

Power MOSFET

PRODUCT SUMMARY

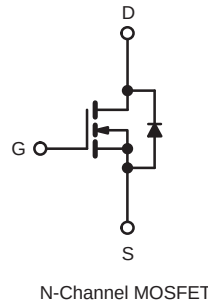
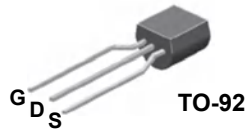
V_{DS} (V)	650	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10\text{ V}$	8
Q_g (Max.) (nC)	18	
Q_{gs} (nC)	3.0	
Q_{gd} (nC)	8.9	
Configuration	Single	

FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Dynamic dV/dt Rating
- Repetitive Avalanche Rated
- Available in Tape and Reel
- Fast Switching
- Ease of Paralleling
- Compliant to RoHS Directive 2002/95/EC



RoHS*
COMPLIANT
HALOGEN
FREE
Available



ABSOLUTE MAXIMUM RATINGS $T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-Source Voltage			V _{DS}	650	V
Gate-Source Voltage			V _{GS}	± 20	
Continuous Drain Current	V _{GS} at 10 V	T _C = 25 °C	I _D	1.0	A
		T _C = 100 °C		0.7	
Pulsed Drain Current ^a			I _{DM}	2.0	W/°C
Linear Derating Factor				0.33	
Linear Derating Factor (PCB Mount) ^e				0.020	
Single Pulse Avalanche Energy ^b			E _{AS}	74	mJ
Repetitive Avalanche Current ^a			I _{AR}	2.0	A
Repetitive Avalanche Energy ^a			E _{AR}	4.2	mJ
Maximum Power Dissipation	T _C = 25 °C		P _D	42	W
Maximum Power Dissipation (PCB Mount) ^e	T _A = 25 °C			2.5	
Peak Diode Recovery dV/dt ^c			dV/dt	3.0	V/ns
Operating Junction and Storage Temperature Range			T _J , T _{stg}	- 55 to + 150	°C
Soldering Recommendations (Peak Temperature)	for 10 s			260 ^d	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 50\text{ V}$, starting $T_J = 25\text{ }^\circ\text{C}$, $L = 37\text{ mH}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 2.0\text{ A}$ (see fig. 12).
- $I_{SD} \leq 2.0\text{ A}$, $dI/dt \leq 40\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^\circ\text{C}$.
- 1.6 mm from case.
- When mounted on 1" square PCB (FR-4 or G-10 material).

* Pb containing terminations are not RoHS compliant, exemptions may apply

THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	-	110	°C/W
Maximum Junction-to-Ambient (PCB Mount) ^a	R_{thJA}	-	-	50	
Maximum Junction-to-Case (Drain)	R_{thJC}	-	-	3.0	

Note

a. When mounted on 1" square PCB (FR-4 or G-10 material).

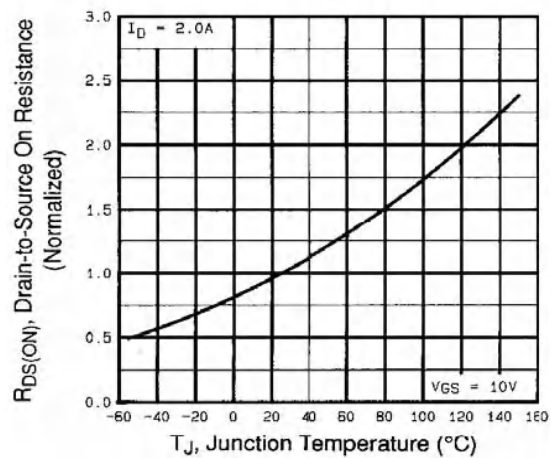
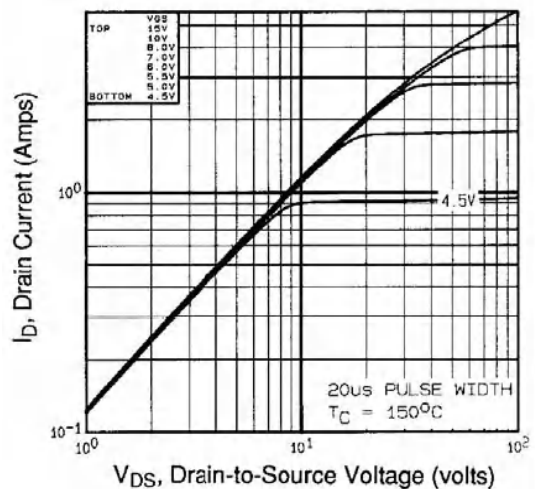
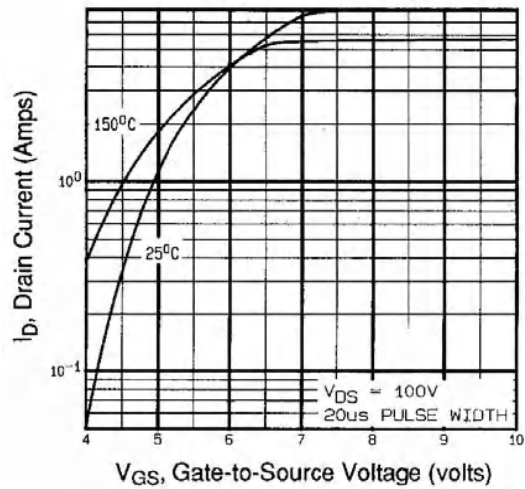
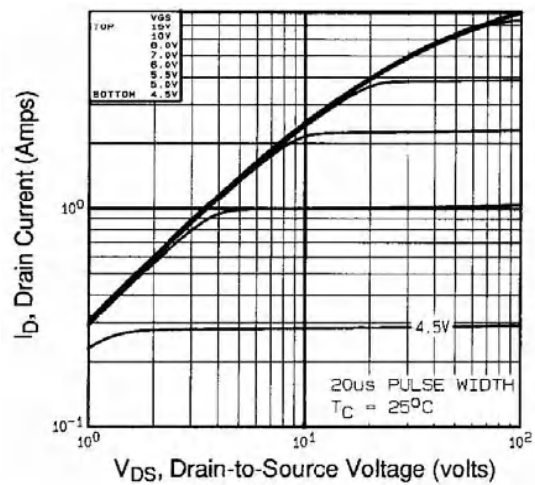
SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA		650	-	-	V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	Reference to 25 °C, I _D = 1 mA		-	0.88	-	V/°C
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA		2.0	-	4.0	V
Gate-Source Leakage	I _{GSS}	V _{GS} = ± 20 V		-	-	± 100	nA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 600 V, V _{GS} = 0 V		-	-	100	μA
		V _{DS} = 480 V, V _{GS} = 0 V, T _J = 125 °C		-	-	500	
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} = 10 V	I _D = 1.0A ^b	--	8	-	Ω
Forward Transconductance	g _{fs}	V _{DS} = 50 V, I _D = 1.0 A		1.4	-	-	S
Dynamic							
Input Capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = - 25 V, f = 1.0 MHz, see fig. 5		-	350	-	pF
Output Capacitance	C _{oss}			-	48	-	
Reverse Transfer Capacitance	C _{rss}			-	8.6	-	
Total Gate Charge	Q _g	V _{GS} = 10 V	I _D = 1.0 A, V _{DS} = 360 V, see fig. 6 and 13 ^b	-	-	18	nC
Gate-Source Charge	Q _{gs}			-	-	3.0	
Gate-Drain Charge	Q _{gd}			-	-	8.9	
Turn-On Delay Time	t _{d(on)}	V _{DD} = 300 V, I _D = 1.0 A, R _g = 18 Ω, R _D = 135 Ω, see fig. 10 ^b		-	10	-	ns
Rise Time	t _r			-	23	-	
Turn-Off Delay Time	t _{d(off)}			-	30	-	
Fall Time	t _f			-	25	-	
Internal Drain Inductance	L _D	Between lead, 6 mm (0.25") from package and center of die contact		-	4.5	-	nH
Internal Source Inductance	L _S			-	7.5	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I _S	MOSFET symbol showing the integral reverse p - n junction diode		-	-	2.0	A
Pulsed Diode Forward Current ^a	I _{SM}			-	-	8.0	
Body Diode Voltage	V _{SD}	T _J = 25 °C, I _S = 2.0 A, V _{GS} = 0 V ^b		-	-	1.6	V
Body Diode Reverse Recovery Time	t _{rr}	T _J = 25 °C, I _F = 2.0 A, dI/dt = 100 A/μs ^b		-	290	580	ns
Body Diode Reverse Recovery Charge	Q _{rr}			-	0.67	1.3	μC
Forward Turn-On Time	t _{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L _S and L _D)					

Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
 b. Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



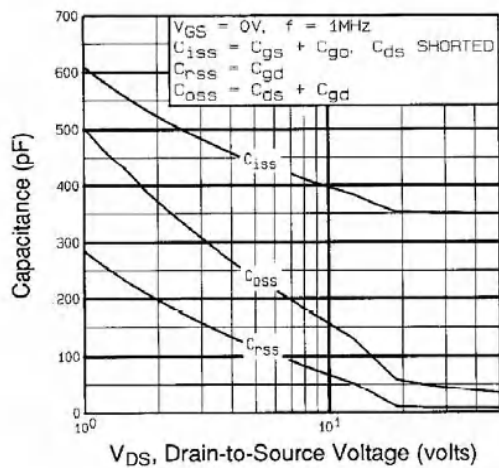


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

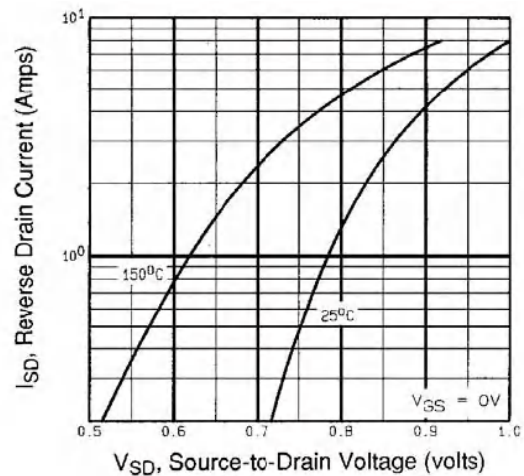


Fig. 7 - Typical Source-Drain Diode Forward Voltage

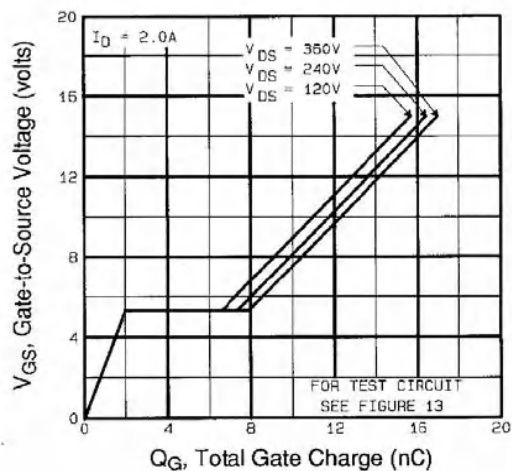


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

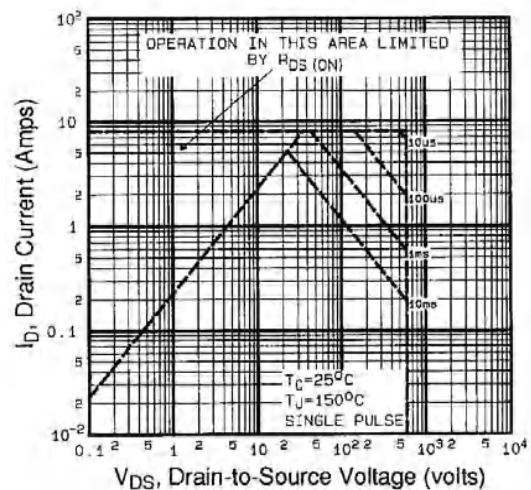


Fig. 8 - Maximum Safe Operating Area

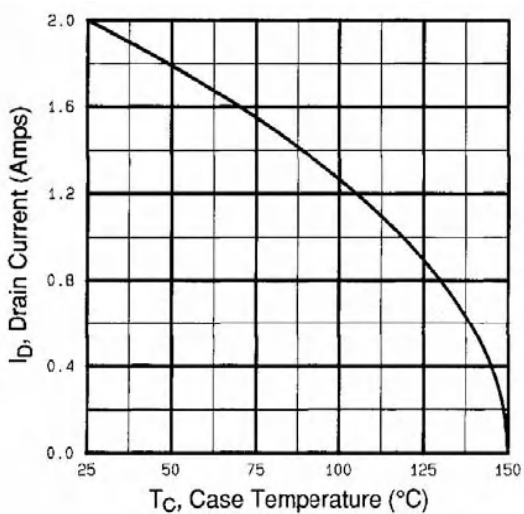


Fig. 9 - Maximum Drain Current vs. Case Temperature

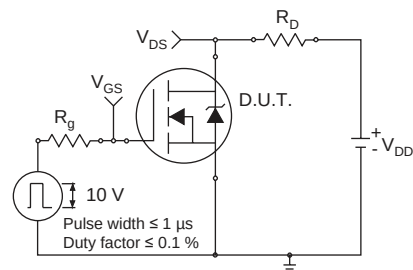


Fig. 10a - Switching Time Test Circuit

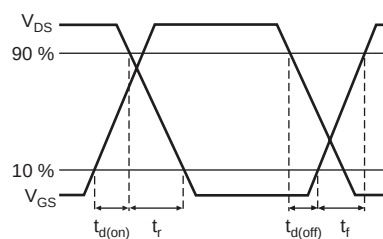


Fig. 10b - Switching Time Waveforms

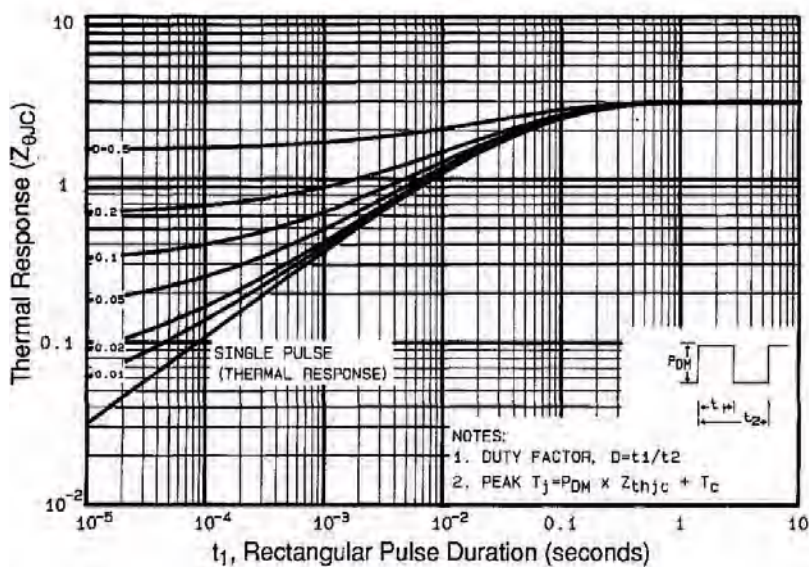


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

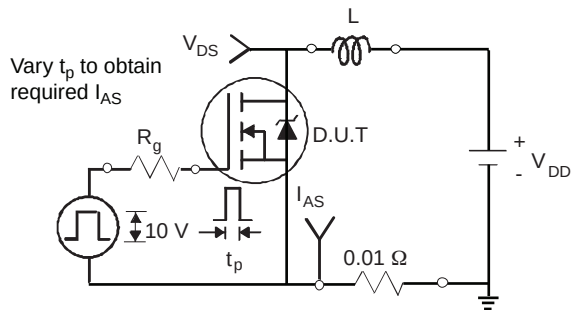


Fig. 12a - Unclamped Inductive Test Circuit

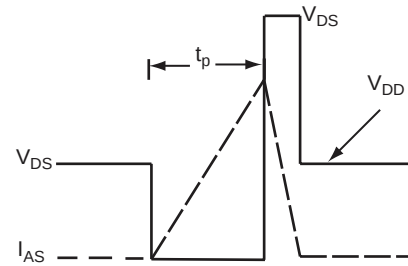


Fig. 12b - Unclamped Inductive Waveforms

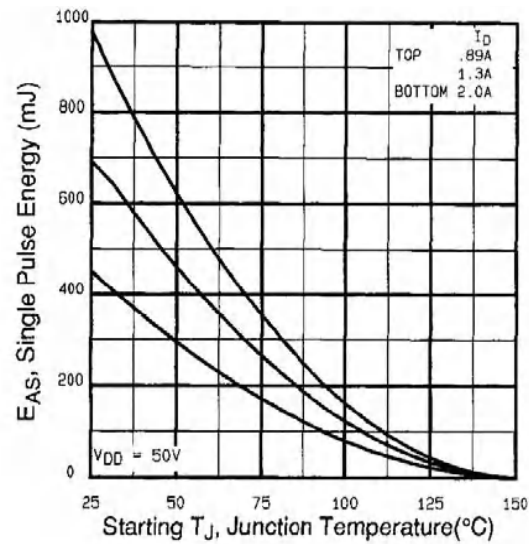


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

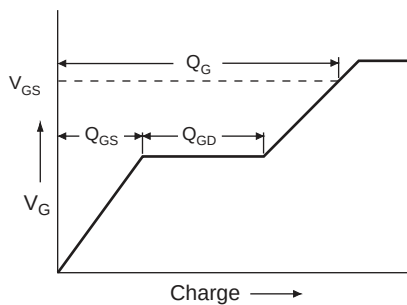


Fig. 13a - Basic Gate Charge Waveform

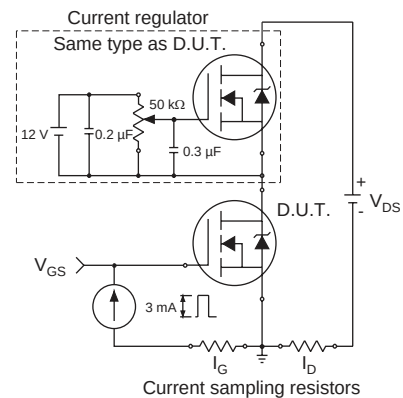
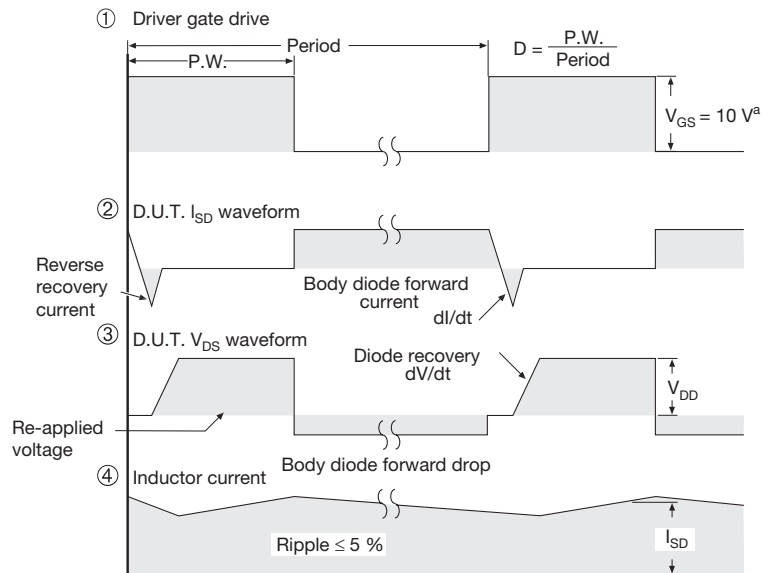
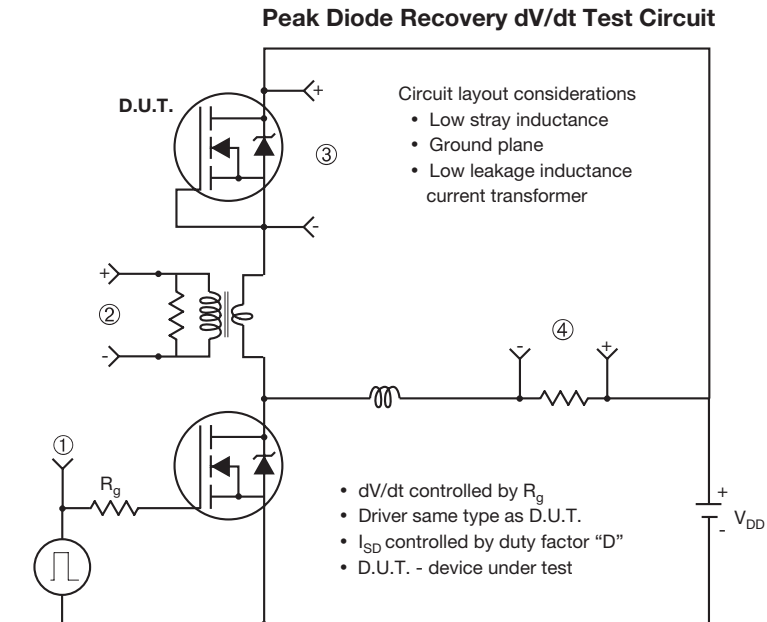


Fig. 13b - Gate Charge Test Circuit



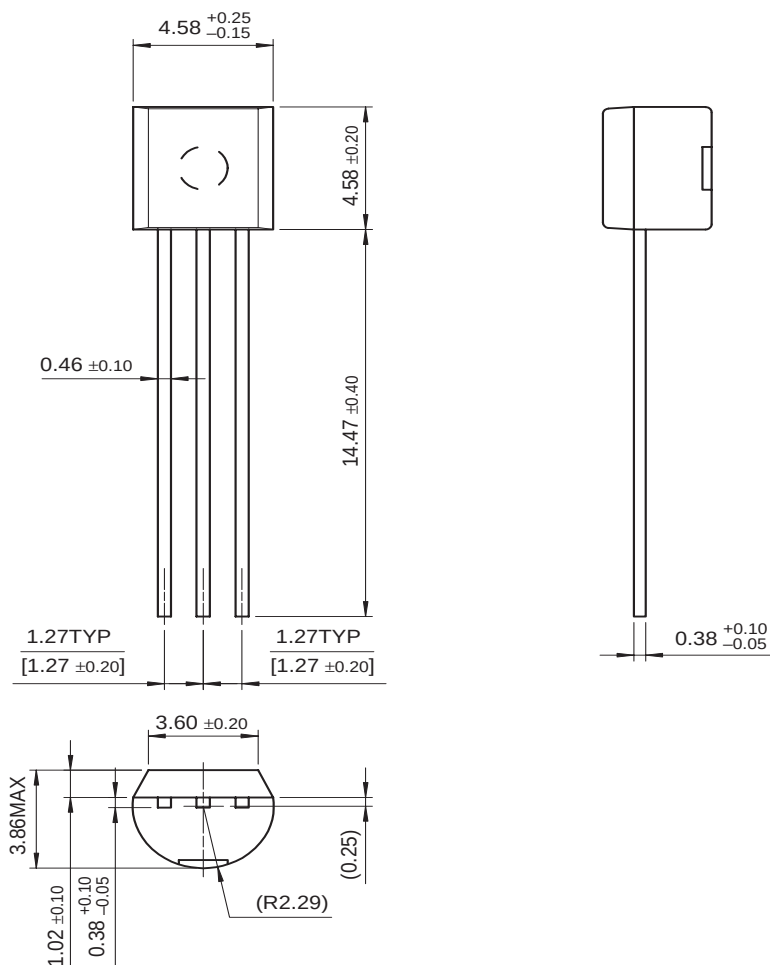
Note

a. $V_{GS} = 5V$ for logic level devices

Fig. 14 - For N-Channel

Mechanical Dimensions

TO-92



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