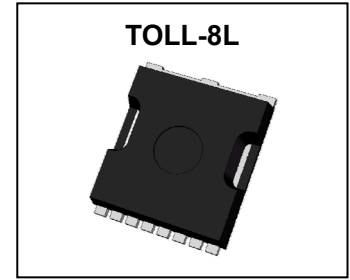


## TOLL-8L Plastic-Encapsulate MOSFET

### CJTLR60SN04AL N-Channel Power MOSFET

#### Key Performance Parameters

V <sub>BR(DSS)</sub>	R <sub>DS(on)</sub> TYP	I <sub>D</sub>
40V	0.44mΩ@10V	420A
	0.60mΩ@4.5V	



#### DESCRIPTION

The N-Channel enhancement mode power field effect transistors is using SGT technology. Both conduction and switching power losses are minimized due to an extremely low combination of R<sub>DS(on)</sub> and Q<sub>g</sub>. This device is ideal for high-frequency switching and synchronous rectification. It can be used in a wide variety of applications.

#### FEATURES

- High Power and current handing capability
- Good stability and uniformity with high E<sub>AS</sub>
- High density cell design for ultra low R<sub>DS(ON)</sub>
- Excellent package for good heat dissipation

#### APPLICATIONS

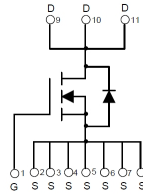
- High-Efficiency DC-DC Converters
- BLDC Motor drive applications
- Synchronous rectifier applications

#### MARKING



XXXXXXXXX = TLR60SN04AL  
 Solid dot = Pin1 indicator.  
 YYYY = Code.

#### EQUIVALENT CIRCUIT



#### ABSOLUTE MAXIMUM RATINGS ( T<sub>J</sub>=25°C unless otherwise specified )

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V <sub>DS</sub>	40	V
Gate-Source Voltage	V <sub>GS</sub>	±20	V
Continuous Drain Current	I <sub>D</sub>	T <sub>C</sub> = 25°C	420
		T <sub>C</sub> = 100°C	266
Pulsed Drain Current	I <sub>DM</sub> <sup>①②</sup>	1680	A
Continuous Drain Current	I <sub>D</sub>	T <sub>A</sub> = 25°C	52
		T <sub>A</sub> = 75°C	40.5
Avalanche Current	I <sub>AS</sub> <sup>③</sup>	72	A
Single Pulsed Avalanche Energy	E <sub>AS</sub> <sup>③</sup>	1296	mJ
Power Dissipation	P <sub>D</sub> <sup>①</sup>	500	W
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55~+150	°C

#### Thermal Characteristics

Parameter	Symbol	Value		Unit
		Typ	Max	
Thermal Resistance from Junction to Case	R <sub>θJC</sub>	0.16	0.25	°C/W
Thermal Resistance from Junction to Ambient	R <sub>θJA</sub> <sup>⑥</sup>	35	50	°C/W

# Typical Characteristics

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub>=25°C unless otherwise specified)

### Static Characteristics

Parameter	Symbol	Test Condition	Value			Unit	
			Min	Typ	Max		
Drain-source breakdown voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA	40	-	-	V	
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = 40V, V <sub>GS</sub> = 0V	T <sub>J</sub> = 25°C	-	-	1.0	μA
			T <sub>J</sub> = 125°C	-	-	100	
Gate-body leakage current	I <sub>GSS</sub>	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V	-	-	±100	nA	
Gate-threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	1.3	1.6	2.5	V	
Static drain-source on-state resistance	R <sub>DS(on)</sub> <sup>④</sup>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 50A	T <sub>J</sub> = 25°C	-	0.44	0.60	mΩ
			T <sub>J</sub> = 125°C	-	0.61	0.83	
		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 50A	-	0.60	0.85		
Forward transconductance	g <sub>FS</sub>	V <sub>DS</sub> = 5V, I <sub>D</sub> = 50A	-	292	-	S	

### Dynamic Characteristics<sup>⑤</sup>

Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 20V, f = 1MHz	-	16396	-	pF
Output capacitance	C <sub>oss</sub>		-	6014	-	
Reverse transfer capacitance	C <sub>riss</sub>		-	444	-	
Gate resistance	R <sub>g</sub>	f = 1MHz	-	1.9	-	Ω
Total gate charge	Q <sub>g</sub>	V <sub>GS</sub> = 4.5V, V <sub>DS</sub> = 32V, I <sub>D</sub> = 50A	-	120	-	nC
Total gate charge	Q <sub>g</sub>	V <sub>GS</sub> = 10V, V <sub>DS</sub> = 32V, I <sub>D</sub> = 50A	-	247	-	
Gate charge at threshold	Q <sub>G(th)</sub>		-	24	-	
Gate-source charge	Q <sub>gs</sub>		-	31	-	
Gate-drain charge	Q <sub>gd</sub>		-	36	-	
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = 20V, V <sub>GS</sub> = 10V, I <sub>D</sub> = 50A, R <sub>g</sub> = 4Ω	-	16	-	ns
Turn-on rise time	t <sub>r</sub>		-	38	-	
Turn-off delay time	t <sub>d(off)</sub>		-	229	-	
Turn-off fall time	t <sub>f</sub>		-	136	-	

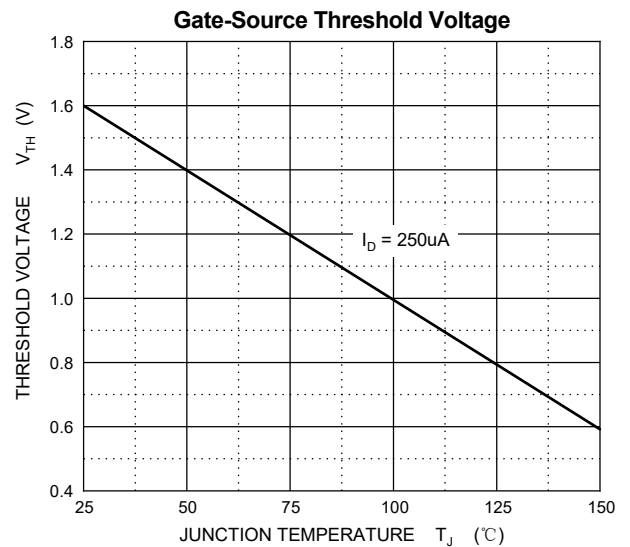
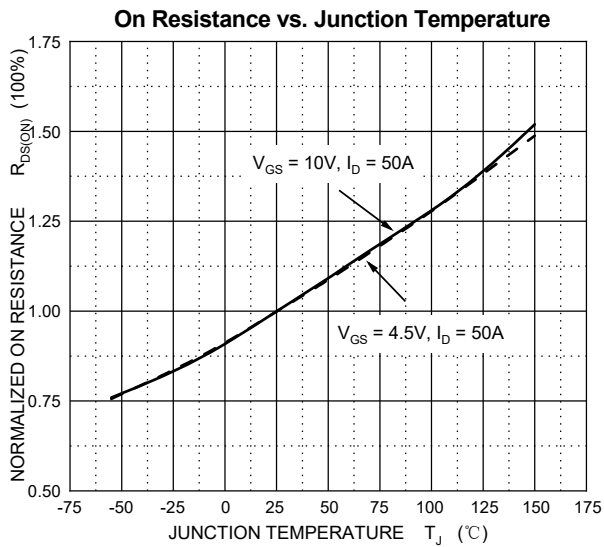
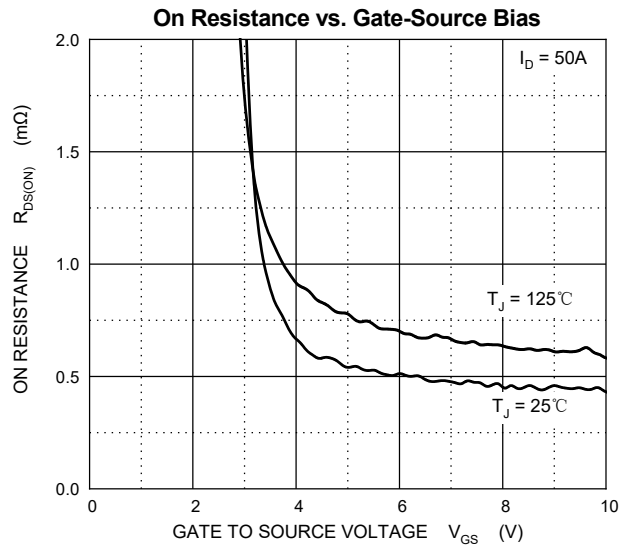
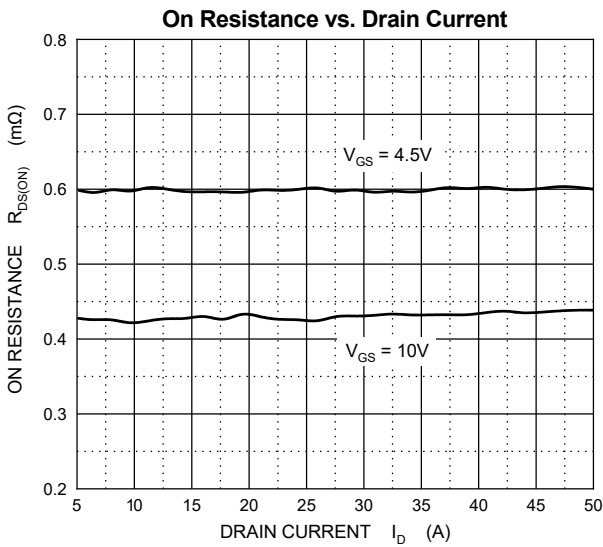
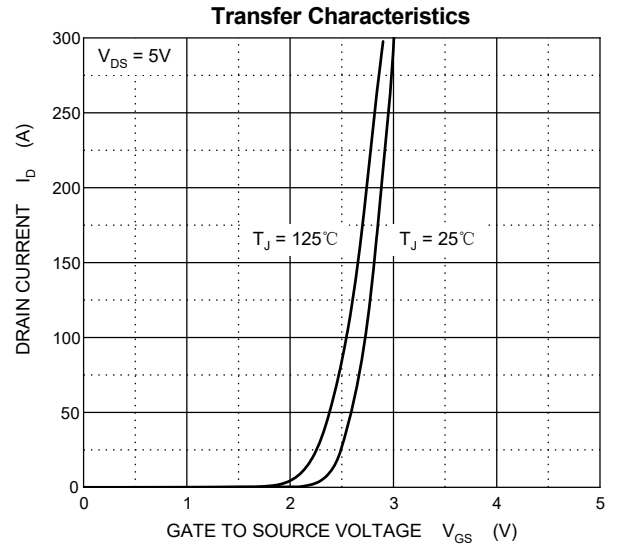
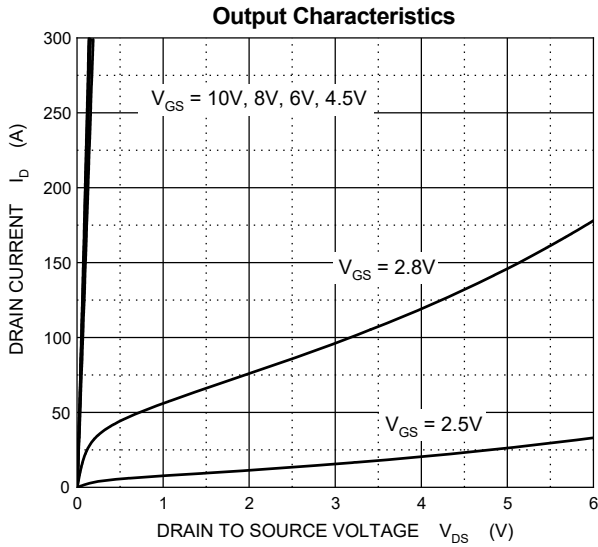
### Reverse Diode Characteristics

Drain-source diode forward voltage	V <sub>SD</sub> <sup>④</sup>	V <sub>GS</sub> = 0V, I <sub>S</sub> = 50A	-	-	1.2	V
Continuous drain-source diode forward current	I <sub>S</sub> <sup>①</sup>		-	-	420	A
Pulsed drain-source diode forward current	I <sub>SM</sub> <sup>①②</sup>		-	-	1680	A
Reverse recovery time	t <sub>rr</sub>	V <sub>DD</sub> = 20V, I <sub>S</sub> = 30A,	-	95	-	ns
Reverse recovery charge	Q <sub>rr</sub>	di/dt = 100A/μs	-	128	-	nC

Notes:

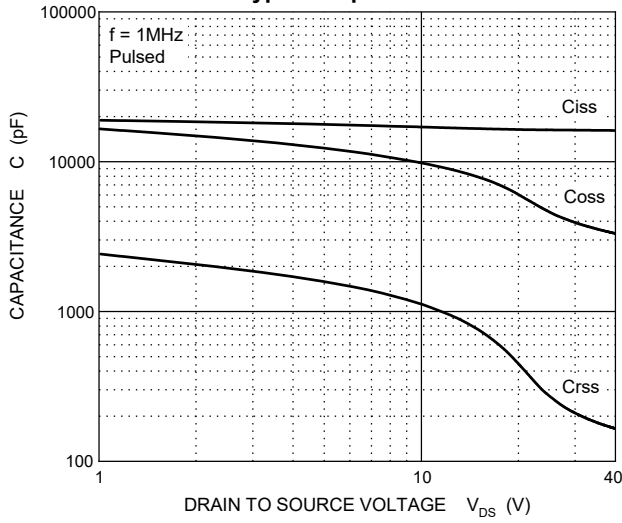
- ①. T<sub>C</sub> = 25°C Limited only by maximum temperature allowed.
- ②. P<sub>W</sub> ≤ 10μs, Duty cycle ≤ 1%.
- ③. EAS condition: V<sub>DD</sub> = 20V, V<sub>GS</sub> = 10V, L = 0.5mH, R<sub>g</sub> = 25Ω Starting T<sub>J</sub> = 25°C.
- ④. Pulse Test : Pulse Width ≤ 380μs, duty cycle ≤ 2%.
- ⑤. Guaranteed by design, not subject to production.
- ⑥. Device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. double-sided Copper, in a still air environment with T<sub>A</sub> = 25°C.

# Typical Characteristics

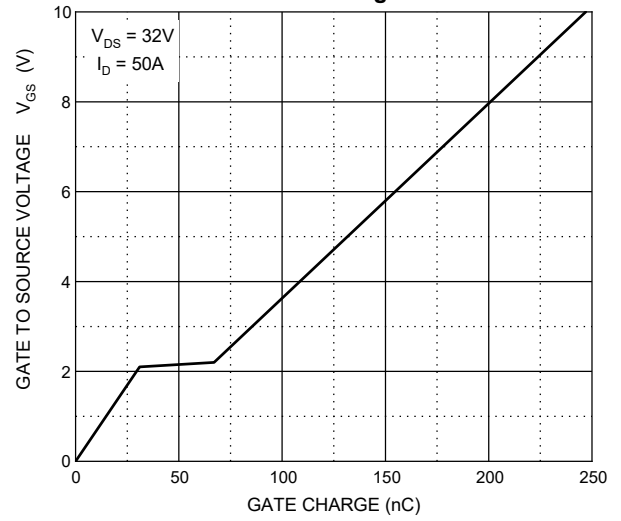


# Typical Characteristics

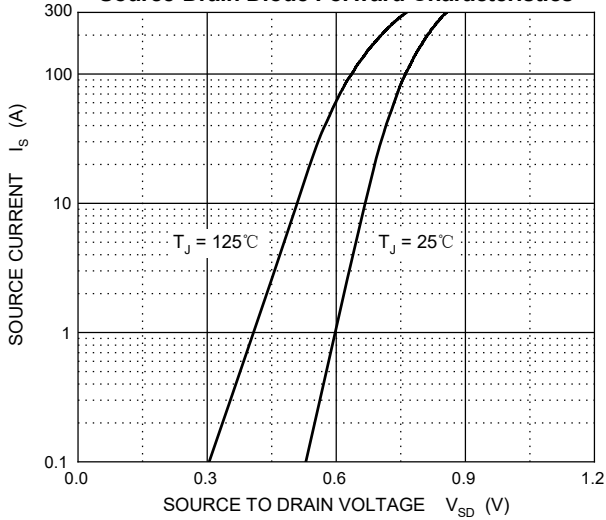
**Typical Capacitances**



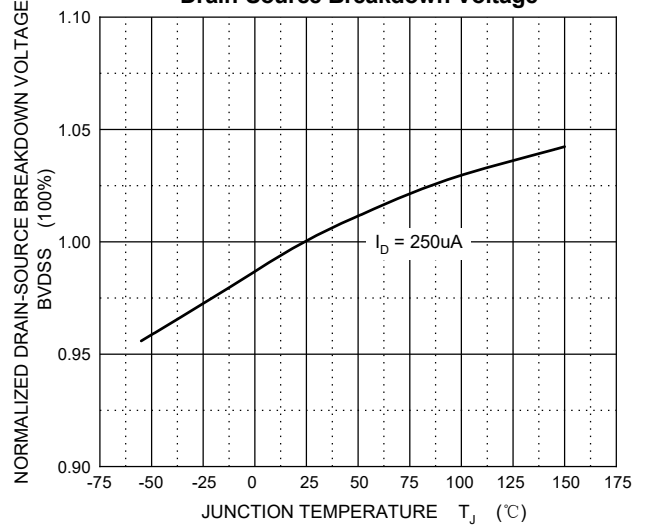
**Gate Charge**



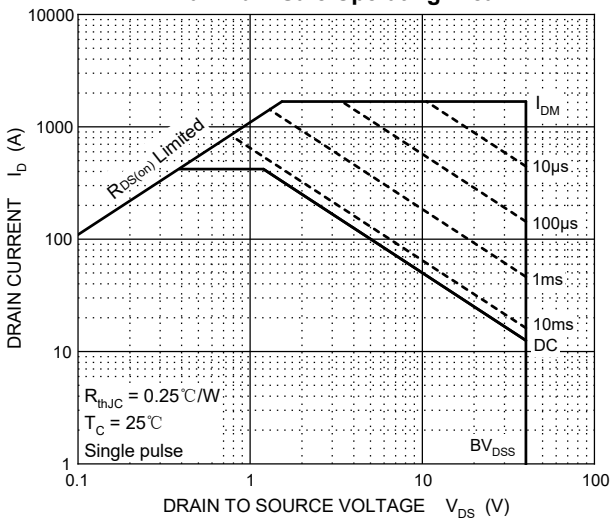
**Source-Drain Diode Forward Characteristics**



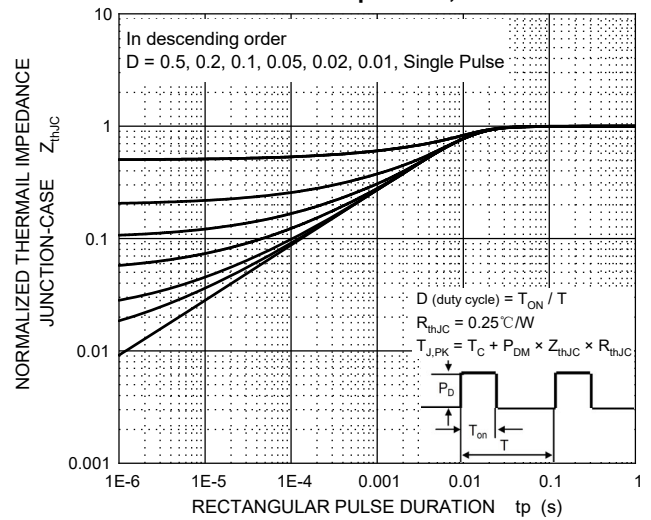
**Drain-Source Breakdown Voltage**



**Maximum Safe Operating Area**



**Transient Thermal Impedance, Junction-Case**

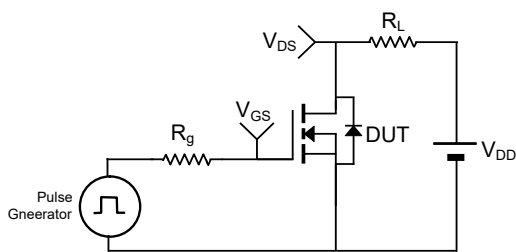


# TEST CIRCUIT AND WAVEFORMS

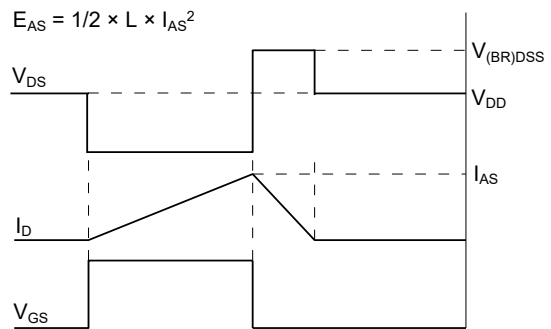
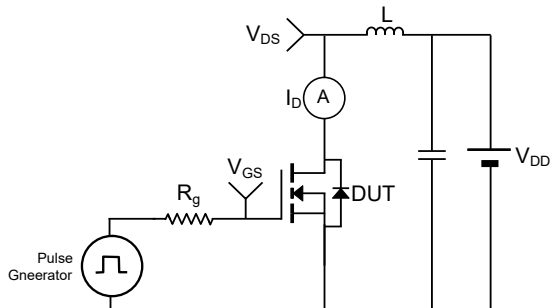
## Gate Charge



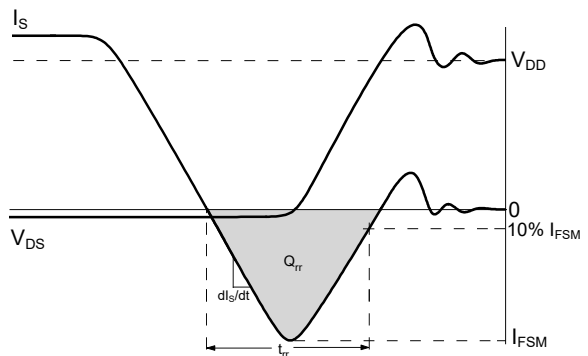
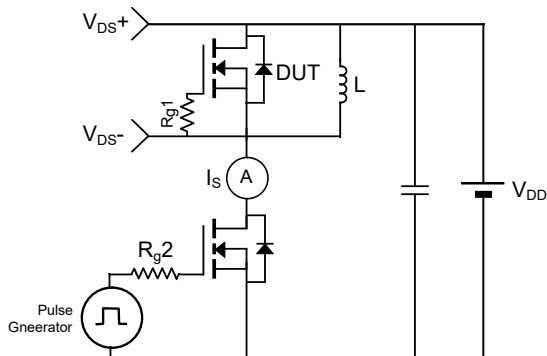
## Resistive Load Switching Time



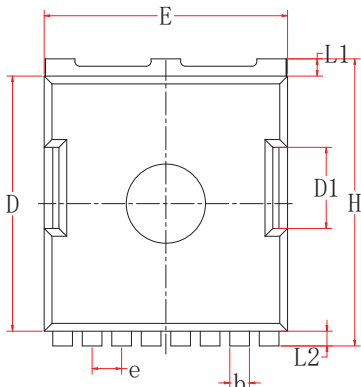
## Un-clamped Inductive Load Switching



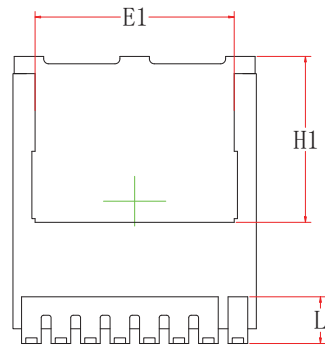
## Drain-Source Body Diode Reverse Recovery



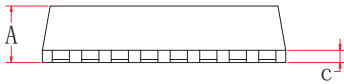
# TOLL-8L PACKAGE OUTLINE DIMENSIONS



Top View  
[顶视图]



Bottom View  
[背视图]



Side View  
[侧视图]

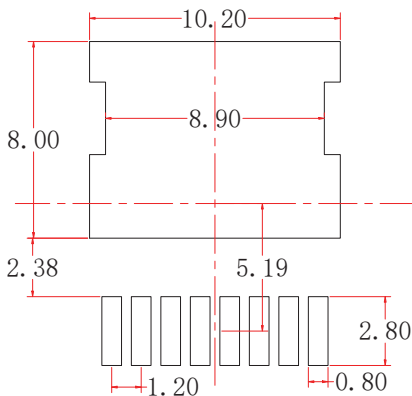
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.20	2.40	0.087	0.094
b	0.70	0.90	0.028	0.035
c	0.40	0.60	0.016	0.024
D	10.28	10.58	0.405	0.417
D1	3.30BSC.		0.130BSC.	
E	9.70	10.10	0.382	0.398
E1	8.00	8.40	0.315	0.331
e	1.20BSC.		0.047BSC.	
H	11.48	11.88	0.452	0.468
H1	7.10BSC.		0.280 BSC.	
L	1.55	1.95	0.061	0.077
	0.50	0.90	0.020	0.035
	0.50	0.70	0.020	0.028

L1  
L2

## Notes:

- 1 Dimensions exclusive of mold gate burrs
- 2 Dimensions exclusive of mold flash and cutting burrs

# TOLL-8L Suggested Pad Layout



## Notes:

- 1 Controlling dimension: in millimeters.
- 2 General tolerance:  $\pm 0.05\text{mm}$ .
- 3 The pad layout is for reference purpose only.

## NOTICE

JSCJ reserves the right to make modifications, enhancements, improvements, corrections or other changes without further notice to any product herein. JSCJ does not assume any liability arising out of the application or use of any product described herein.