

## NCE Automotive N-Channel Super Trench II Power MOSFET

### Description

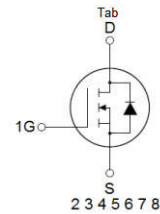
The series of devices uses **Super Trench II** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(ON)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification.

### Application

- Automotive application
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

### General Features

- $V_{DS} = 100V, I_D = 330A$   
 $R_{DS(ON)} = 1.5m\Omega$ , typical @  $V_{GS} = 10V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating
- 100% UIS tested
- 100%  $\Delta V_{ds}$  tested
- **AEC-Q101 qualified**



Schematic Diagram

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
AP020N10LL	NCEAP020N10LL	TOLL-8L	Ø330mm	24mm	2000 units

### Absolute Maximum Ratings ( $T_C = 25^\circ C$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	100	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	330	A
	$I_D (T_C = 100^\circ C)$	240	A
Pulsed Drain Current (Note 1)	$I_{DM}$	1320	A
Maximum Power Dissipation	$P_D$	400	W
Derating factor		2.67	W/°C
Single pulse avalanche energy (Note 4)	$E_{AS}$	2975	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	°C

### Thermal Characteristic

Parameter	Symbol	Typ	Max	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.2	0.38	°C/W

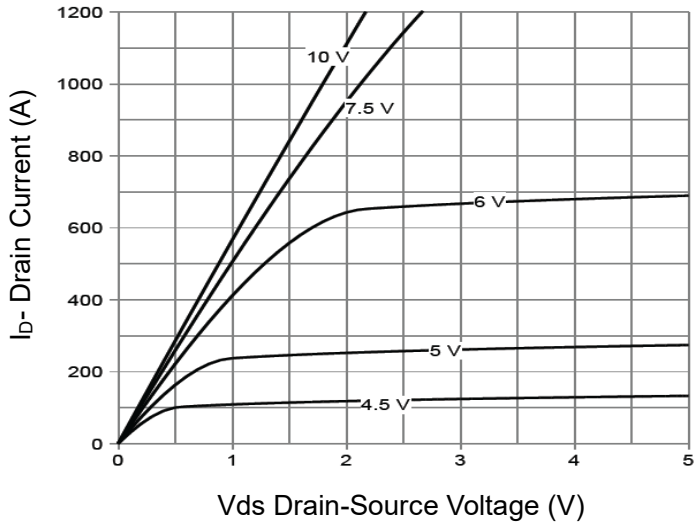
**Electrical Characteristics (T<sub>c</sub>=25°C unless otherwise noted)**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	100	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =100V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA
<b>On Characteristics</b> (Note 2)						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	2.0	3.0	4.0	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =20A	-	1.5	2.0	mΩ
Gate resistance	R <sub>G</sub>	F=1.0MHz	0.2	2.8	4.0	Ω
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =5V, I <sub>D</sub> =165A		200	-	S
<b>Dynamic Characteristics</b> (Note3)						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =50V, V <sub>GS</sub> =0V, F=1.0MHz	-	17000	22100	PF
Output Capacitance	C <sub>oss</sub>		-	1500	1950	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	77	155	PF
<b>Switching Characteristics</b> (Note 3)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =50V, I <sub>D</sub> =20A V <sub>GS</sub> =10V, R <sub>G</sub> =1.6Ω	-	37	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	29	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	82	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	34	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =50V, I <sub>D</sub> =20A, V <sub>GS</sub> =10V	-	252	327.5	nC
Gate-Source Charge	Q <sub>gs</sub>		-	72	93.5	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	63	82	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =20A	-	-	1.2	V
Diode Forward Current (Note 2)	I <sub>S</sub>		-	-	330	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> = 20A	-	105	210	nS
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100A/μs (Note2)	-	290	580	nC

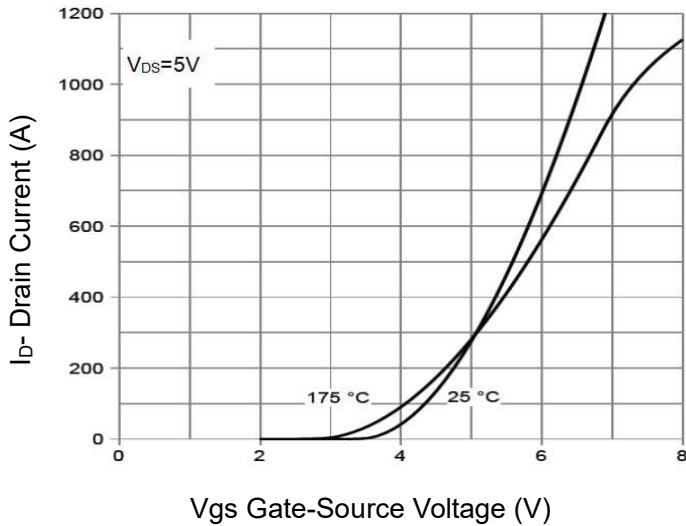
**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. The value of R<sub>θJA</sub> is measured with the device mounted on 1in2 FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub> =25° C. The value in any given application depends on the user's specific board design, and the maximum temperature of 175° C may be used if the PCB allows it.
3. Guaranteed by design, not subject to production
4. EAS condition : T<sub>J</sub>=25°C, V<sub>DD</sub>=50V, V<sub>G</sub>=10V, L=0.5mH, R<sub>G</sub>=25Ω

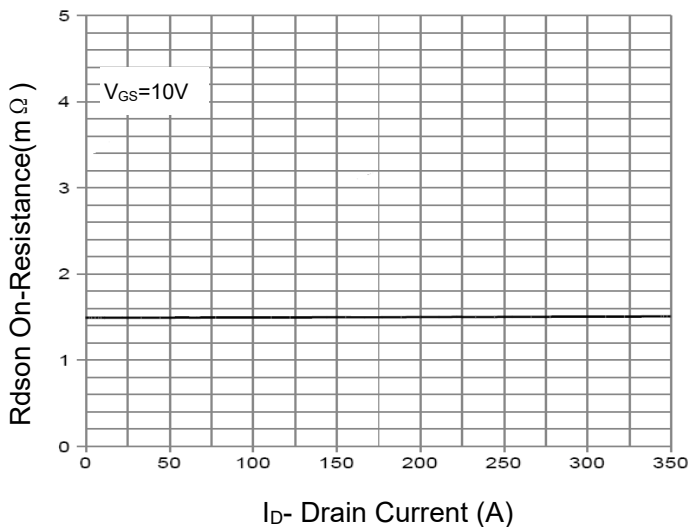
## Typical Electrical and Thermal Characteristics



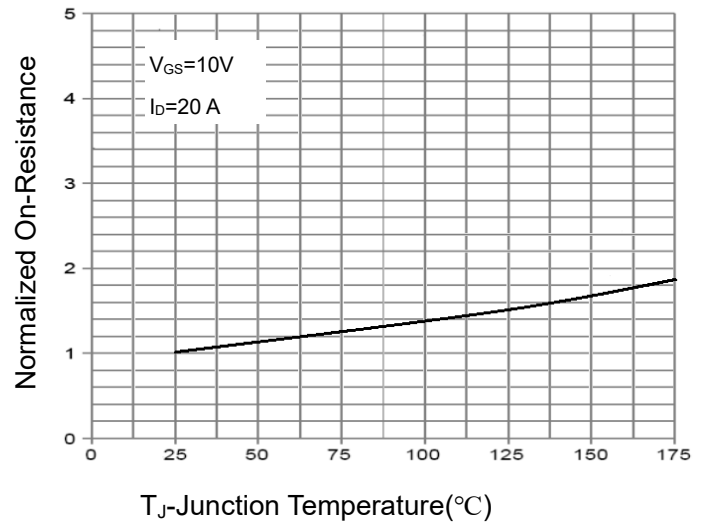
**Figure 1 Output Characteristics**



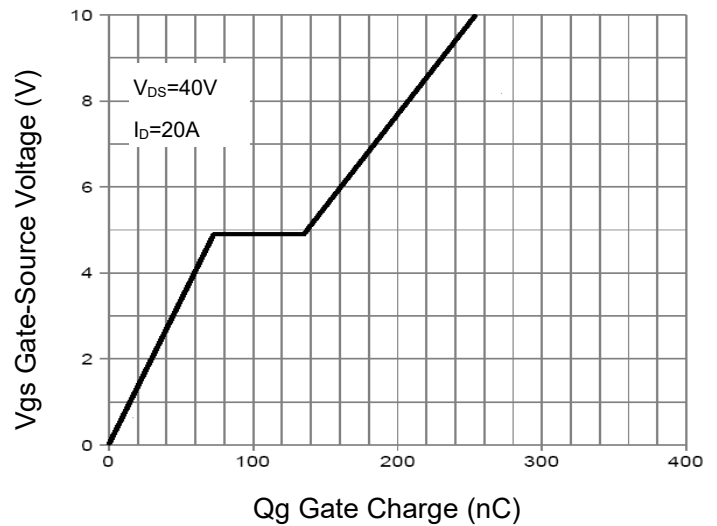
**Figure 2 Transfer Characteristics**



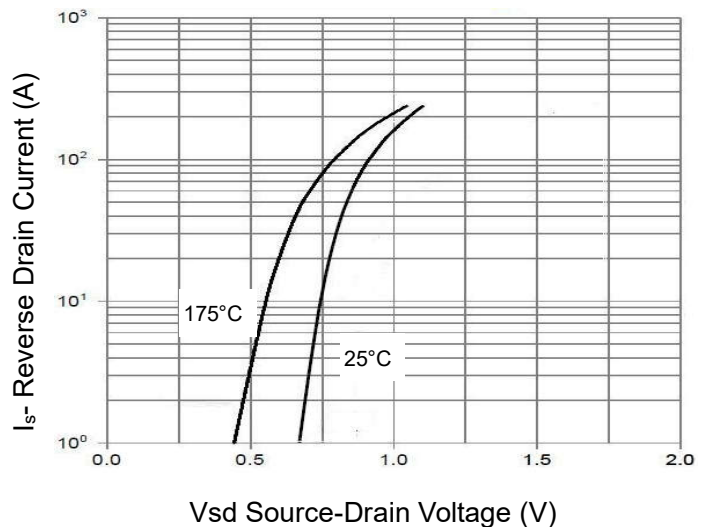
**Figure 3 Rdson- Drain Current**



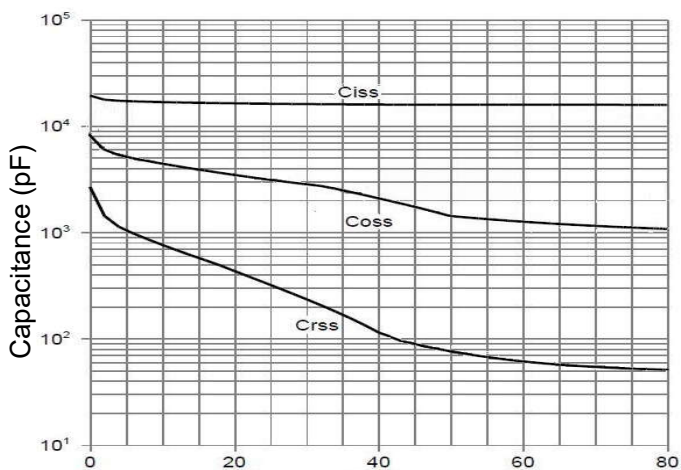
**Figure 4 Rdson-Junction Temperature**



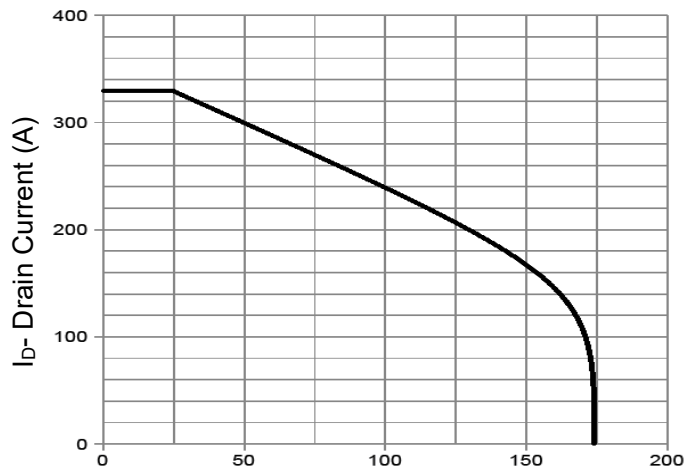
**Figure 5 Gate Charge**



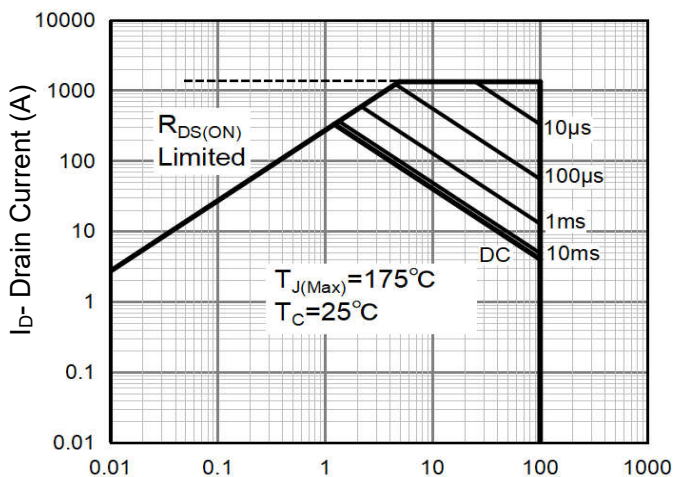
**Figure 6 Source- Drain Diode Forward**



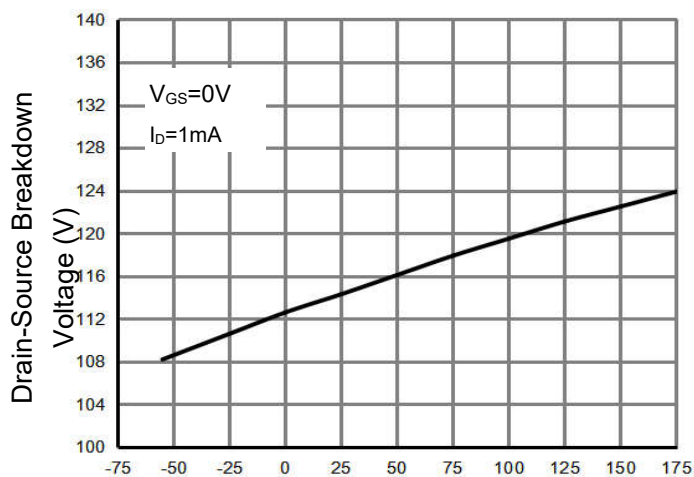
Vds Drain-Source Voltage (V)  
**Figure 7 Capacitance vs Vds**



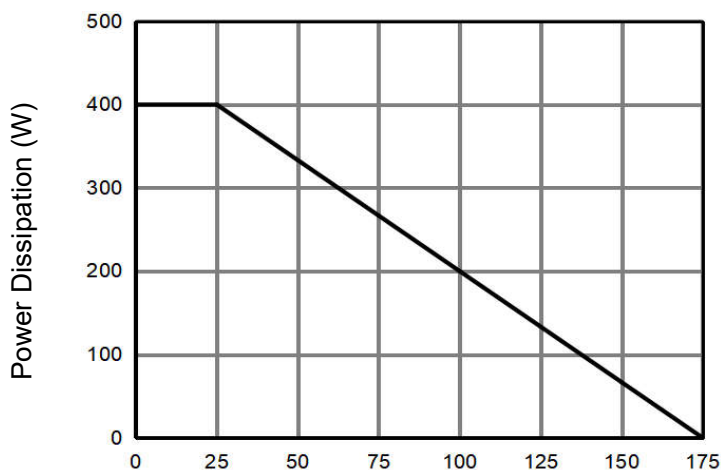
Tc-Case Temperature (°C)  
**Figure 10 Current De-rating**



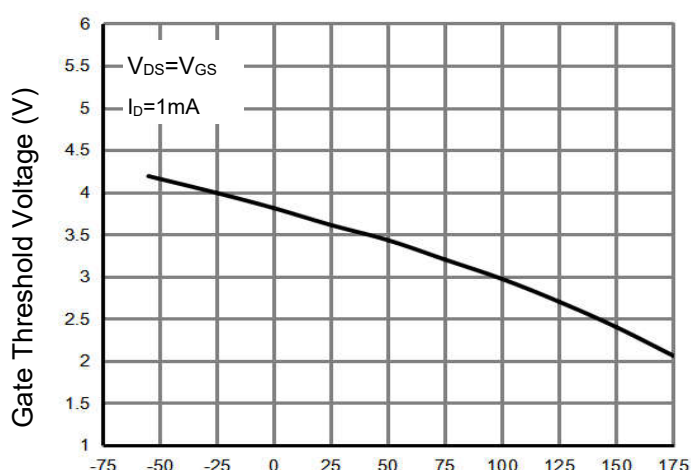
Vds Drain-Source Voltage (V)  
**Figure 8 Safe Operation Area** (Note 3)



Tj-Junction Temperature (°C)  
**Figure 11 BV<sub>DSS</sub>-Junction Temperature**



Tc-Case Temperature (°C)  
**Figure 9 Power De-rating**



Tj-Junction Temperature (°C)  
**Figure 12 V<sub>GS(th)</sub>-Junction Temperature**

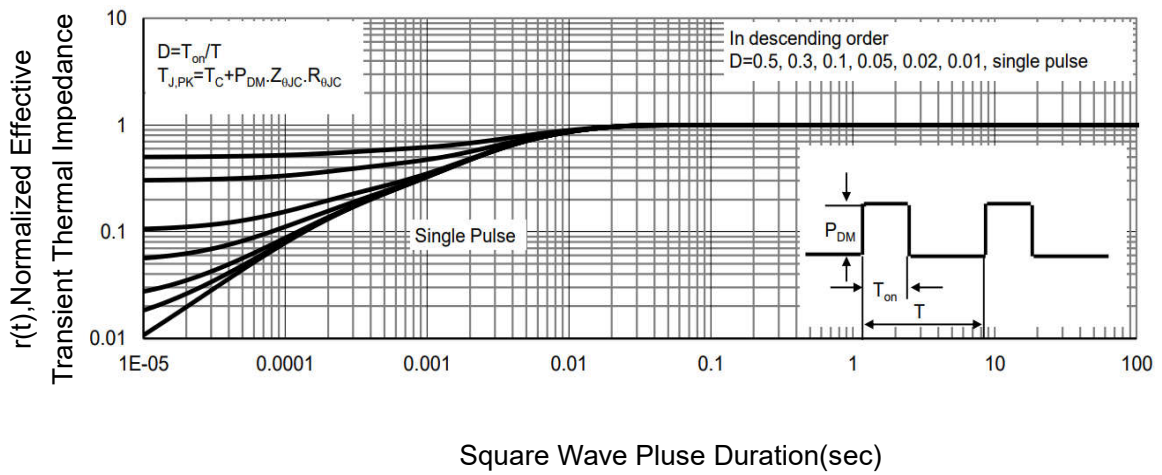
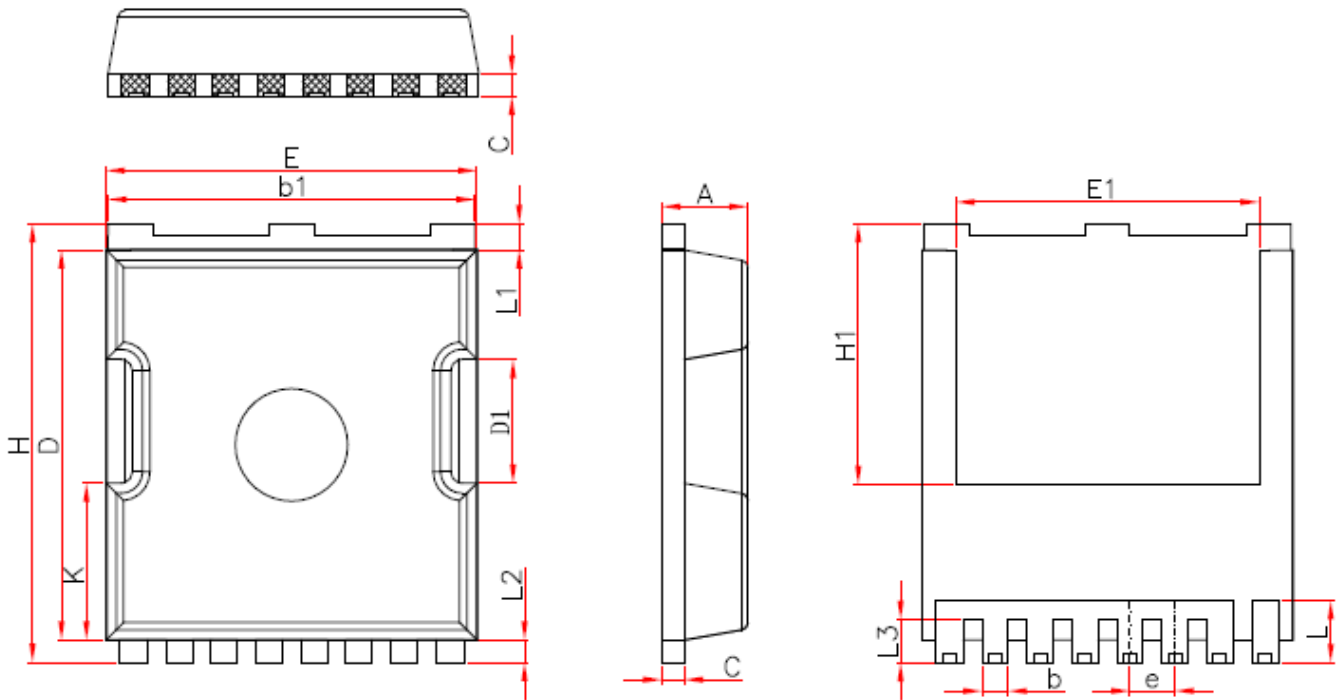


Figure 13 Normalized Maximum Transient Thermal Impedance

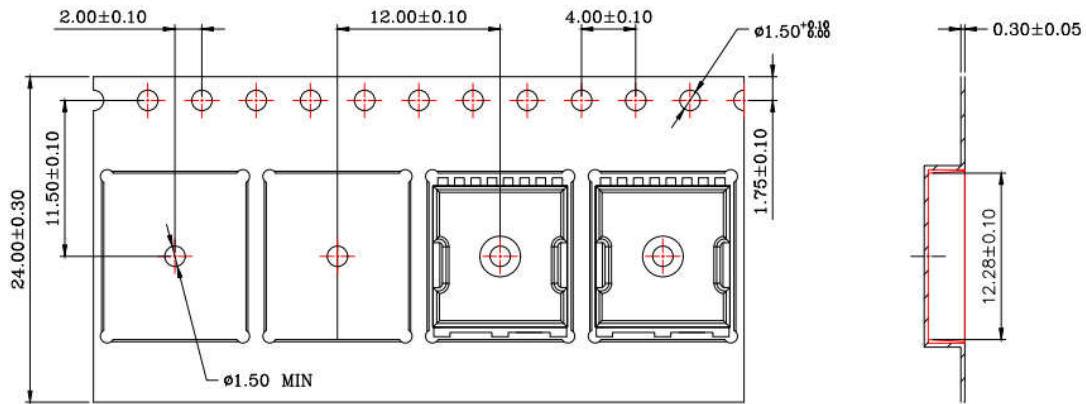
## TOLL-8L Package Information



Symbol	Millimeters		
	Min.	Nom.	Max.
A	2.20	2.30	2.40
b	0.65	0.75	0.85
b1	9.70	9.80	9.90
C	0.50	0.60	0.70
D	10.30	10.40	10.50
D1	3.15	3.3	3.45
E	9.70	9.90	10.10
E1	8.00	8.10	8.20
e	1.10	1.20	1.30
H	11.6	11.7	11.8
H1	6.85	6.95	7.05
K	4.08	4.18	4.28
L	1.60	1.65	2.10
L1	0.60	0.70	0.80
L2	0.50	0.60	0.70
L3	1.05	1.20	1.30

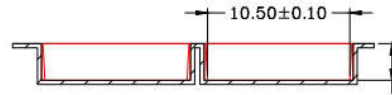
## Package information

### 一、载带图纸:



#### Notes:

1. All dimensions are in mm.
2. Material: Black Conductive Polystyrene Alloy
3. 10 sprocket hole pitch cumulative tolerance  $\pm 0.20\text{mm}$ .
4. Carrier camber is within 1 mm in 250 mm.
5. Packing length per 19" reel : 196.0 Meters.
6. There must not be foreign body adhesion and the state of the surface must be excellent.
7. Surface Resistance  $1 \times 10^5 \sim 1 \times 10^{11}$  OHMS/SQ



### 二、包装信息表（满箱信息）

封装形式	包装方式	盘尺寸	只/盘	盘/内盒	只/内盒	内盒/箱	只/箱
TOLL	编带	13 寸	2000	1	2000	8	16000

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