

**Product Summary**

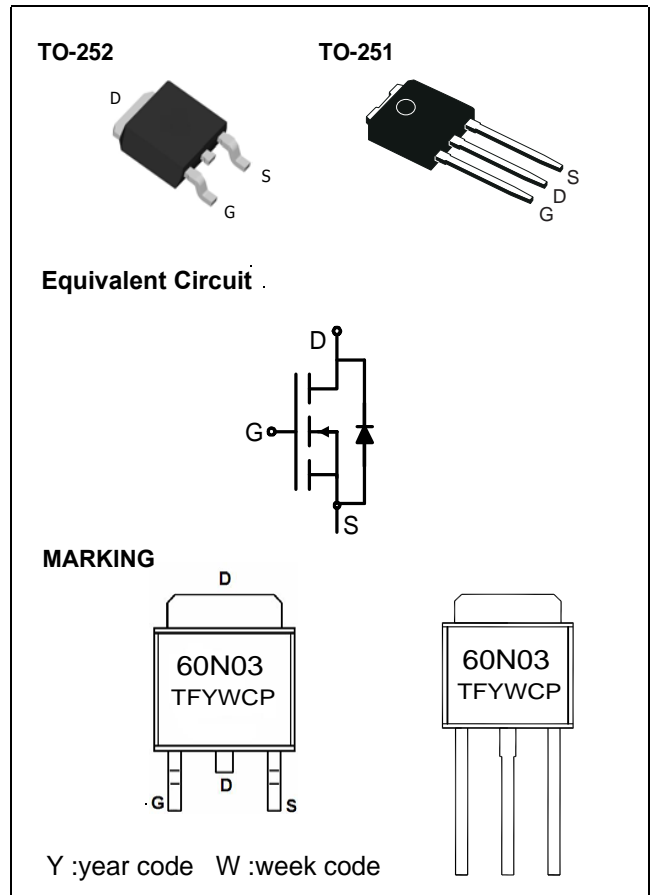
$V_{DS}$	30	V
$R_{DS(on),max}$ SMDversion	9	mΩ
$I_D$	60	A

**Features**

- For fast switching converters and sync. rectification
- N-channel enhancement - normal level
- Avalanche rated
- Pb-free lead plating, RoHS compliant

**Typical Applications**

- Power Supplies
- Converters
- Power Motor Controls
- Bridge Circuits



**Maximum ratings, at  $T_j=25\text{ }^\circ\text{C}$ , unless otherwise specified**

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	$I_D$	$T_a = 25\text{ }^\circ\text{C}$	60	A
Pulsed drain current	$I_{D,pulse}$	$t_p = 10\mu\text{s}$	120	
Avalanche energy, single pulse	$E_{AS}$	$I_D = 60\text{A}$ $R_{GS} = 25\text{ }\Omega$	733	mJ
Gate source voltage	$V_{GS}$		$\pm 20$	V
Power dissipation	$P_{tot}$	$T_C = 25\text{ }^\circ\text{C}$	75	W
Operating and storage temperature	$T_j, T_{stg}$		-55-150	$^\circ\text{C}$
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	$T_L$		260	$^\circ\text{C}$
Thermal Resistance				$^\circ\text{C/W}$
- Junction-to-Case	$R_{\theta JC}$		1.65	
- Junction-to-Ambient (Note 1)	$R_{\theta JA}$		67	
- Junction-to-Ambient (Note 2)	$R_{\theta JA}$		120	

1. When surface mounted to an FR4 board using 1" pad size, (Cu Area 1.127 in<sup>2</sup>).
2. When surface mounted to an FR4 board using the minimum recommended pad size, (Cu Area 0.412 in<sup>2</sup>).

\*Chip current capability limited by package.



**SHENZHEN TUOFENG SEMICONDUCTOR TECHNOLOGY CO.,LTD**  
**N-CHANNEL ENHANCEMENT MODE POWER MOSFET**  
**60N03**

**ELECTRICAL CHARACTERISTICS** ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
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**OFF CHARACTERISTICS**

Drain-to-Source Breakdown Voltage (Note 3) ( $V_{GS} = 0\text{ Vdc}$ , $I_D = 250\ \mu\text{Adc}$ ) Temperature Coefficient (Positive)	$V_{(BR)DSS}$	30		-	Vdc
Zero Gate Voltage Drain Current ( $V_{GS} = 0\text{ Vdc}$ , $V_{DS} = 24\text{ Vdc}$ )	$I_{DSS}$	-	-	50	nAdc
Gate-Body Leakage Current ( $V_{GS} = \pm 20\text{ Vdc}$ , $V_{DS} = 0\text{ Vdc}$ )	$I_{GSS}$	-	-	$\pm 100$	nAdc

**ON CHARACTERISTICS** (Note 3)

Gate Threshold Voltage (Note 3) ( $V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{Adc}$ ) Threshold Temperature Coefficient (Negative)	$V_{GS(th)}$	1.0	1.9	2.0	Vdc mV/ $^\circ\text{C}$
Static Drain-to-Source On-Resistance (Note 3) ( $V_{GS} = 10\text{ Vdc}$ , $I_D = 35\text{ Adc}$ ) ( $V_{GS} = 4.5\text{ Vdc}$ , $I_D = 20\text{ Adc}$ )	$R_{DS(on)}$		8.0 14.0	9.0 15.0	m $\Omega$
Forward Transconductance ( $V_{DS} = 15\text{ Vdc}$ , $I_D = 10\text{ Adc}$ ) (Note 3)	$g_{FS}$	-	20	-	Mhos

**DYNAMIC CHARACTERISTICS**

Input Capacitance	$(V_{DS} = 24\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ , $f = 1.0\text{ MHz}$ )	$C_{iss}$	-	2150	-	pF
Output Capacitance		$C_{oss}$	-	680	-	
Transfer Capacitance		$C_{rss}$	-	260	-	

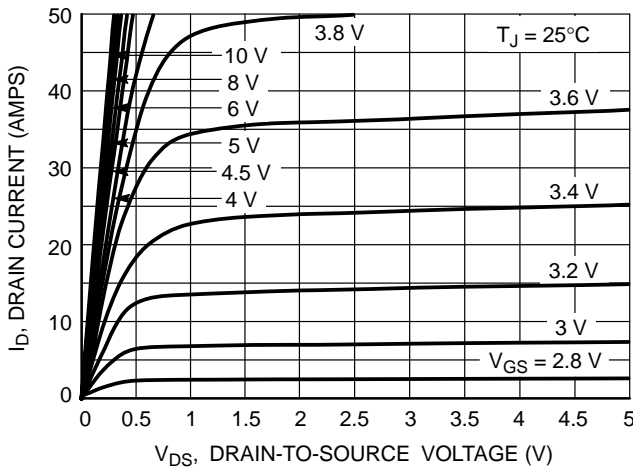
**SWITCHING CHARACTERISTICS** (Note 4)

Turn-On Delay Time	$(V_{DD} = 15\text{ Vdc}$ , $I_D = 15\text{ Adc}$ , $V_{GS} = 10\text{ Vdc}$ , $R_G = 3.3\ \Omega$ )	$t_{d(on)}$	-	10	-	ns
Rise Time		$t_r$	-	18	-	
Turn-Off Delay Time		$t_{d(off)}$	-	32	-	
Fall Time		$t_f$	-	15	-	
Gate Charge	$(V_{DS} = 24\text{ Vdc}$ , $I_D = 15\text{ Adc}$ , $V_{GS} = 4.5\text{ Vdc}$ ) (Note 3)	$Q_T$	-	30	-	nC
		$Q_1$	-	6.5	-	
		$Q_2$	-	18.4	-	

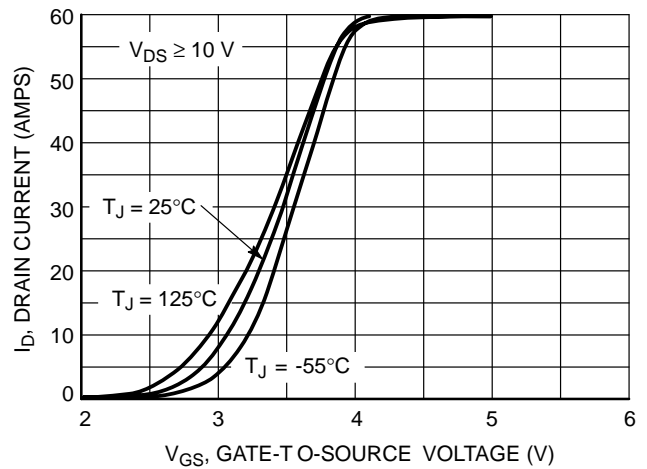
**SOURCE-DRAIN DIODE CHARACTERISTICS**

Forward On-Voltage ( $I_S = 2.3\text{ Adc}$ , $V_{GS} = 0\text{ Vdc}$ ) (Note 3) ( $I_S = 30\text{ Adc}$ , $V_{GS} = 0\text{ Vdc}$ ) ( $I_S = 2.3\text{ Adc}$ , $V_{GS} = 0\text{ Vdc}$ , $T_J = 150^\circ\text{C}$ )	$V_{SD}$	-	0.75	1.0	Vdc
Reverse Recovery Time  ( $I_S = 2.3\text{ Adc}$ , $V_{GS} = 0\text{ Vdc}$ , $di_S/dt = 100\text{ A}/\mu\text{s}$ ) (Note 3)	$t_{rr}$	-	39	-	ns
	$t_a$	-	21	-	
	$t_b$	-	18	-	
Reverse Recovery Stored Charge	$Q_{rr}$	-	0.043	-	$\mu\text{C}$

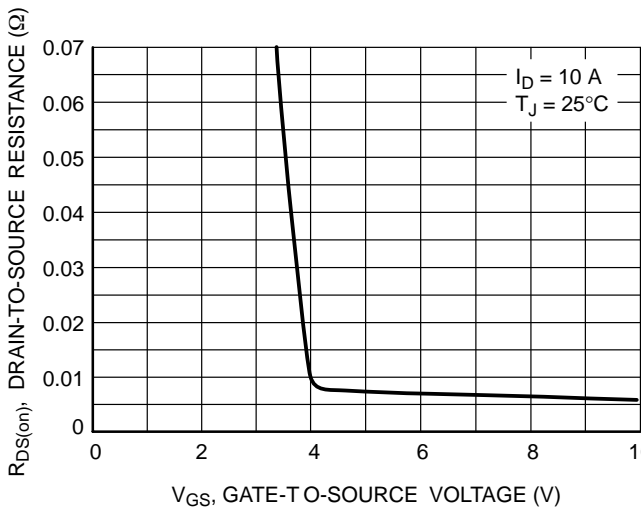
- Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .
- Switching characteristics are independent of operating junction temperatures.



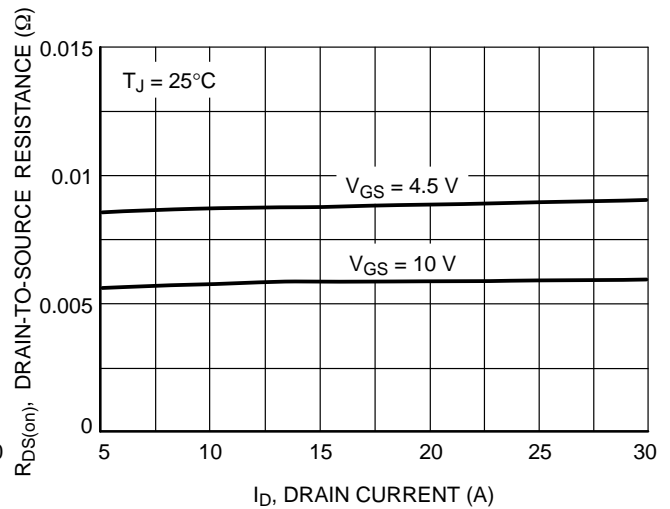
**Figure 1. On-Region Characteristics**



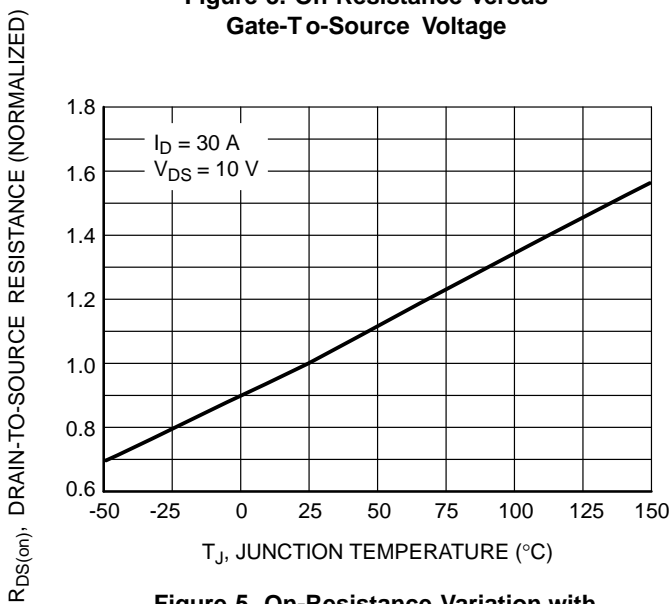
**Figure 2. Transfer Characteristics**



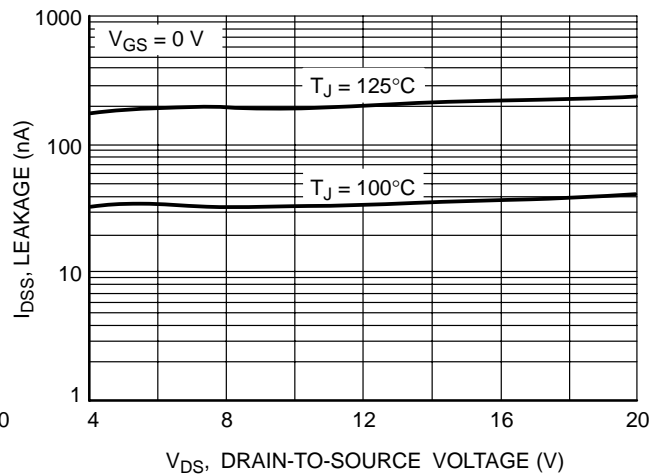
**Figure 3. On-Resistance versus Gate-to-Source Voltage**



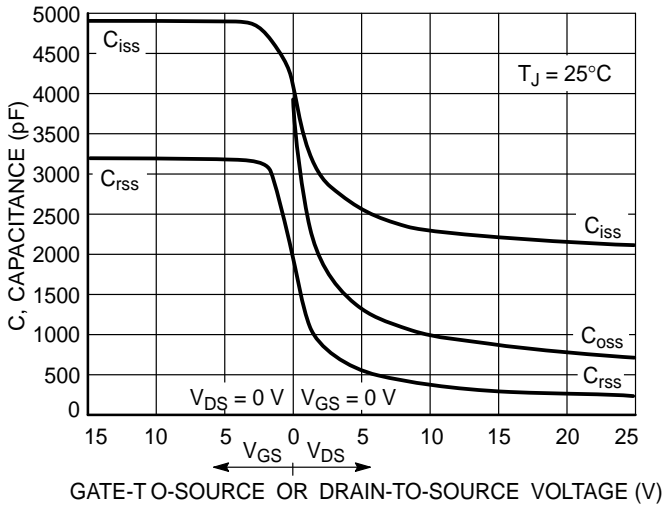
**Figure 4. On-Resistance versus Drain Current and Gate Voltage**



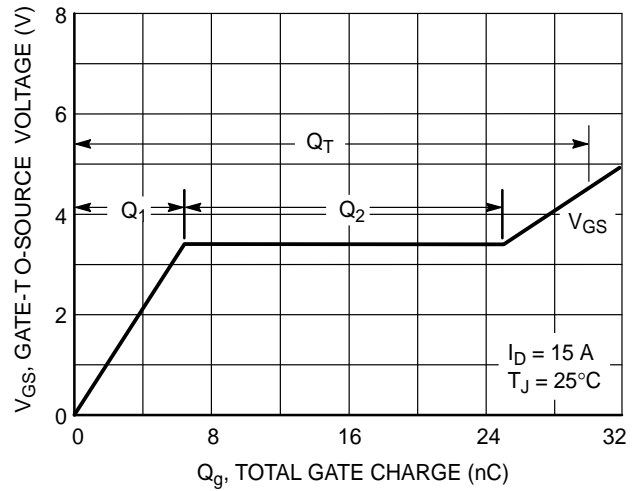
**Figure 5. On-Resistance Variation with Temperature**



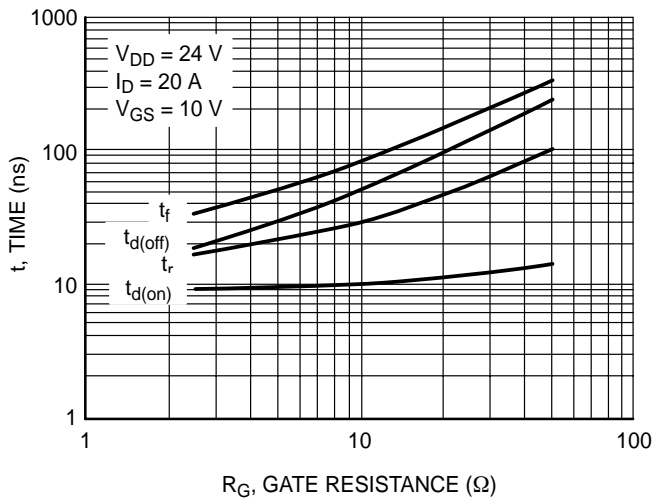
**Figure 6. Drain-to-Source Leakage Current versus Voltage**



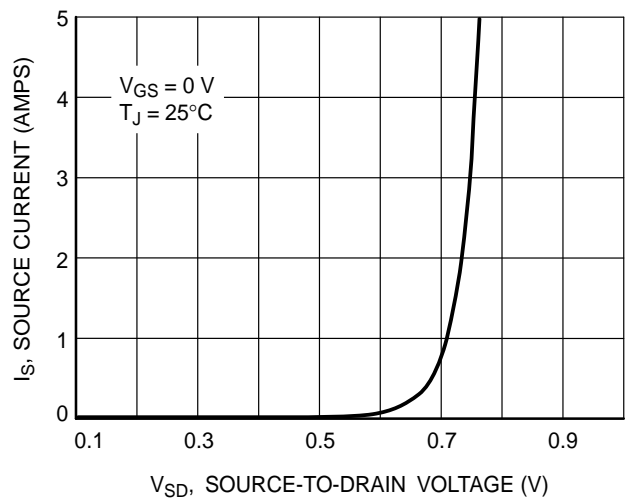
**Figure 7. Capacitance Variation**



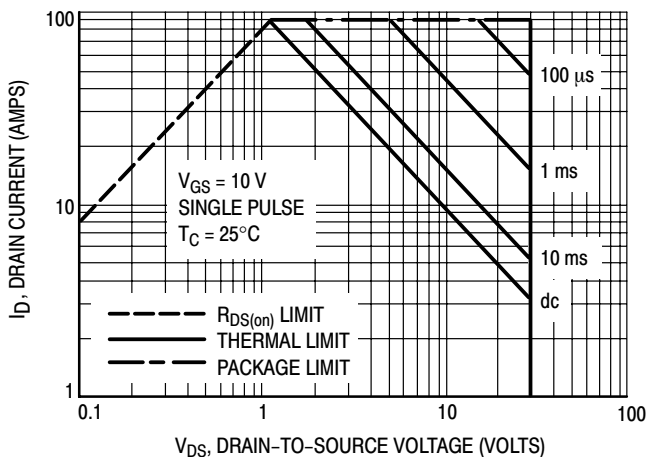
**Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge**



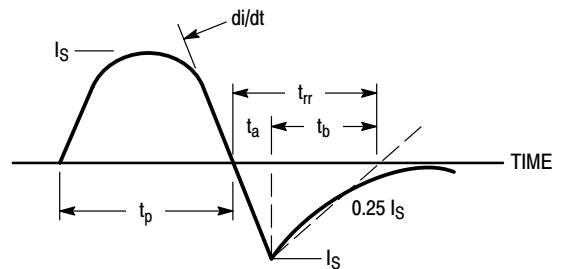
**Figure 9. Resistive Switching Time Variation versus Gate Resistance**



**Figure 10. Diode Forward Voltage versus Current**



**Figure 11. Maximum Rated Forward Biased Safe Operating Area**



**Figure 12. Diode Reverse Recovery Waveform**

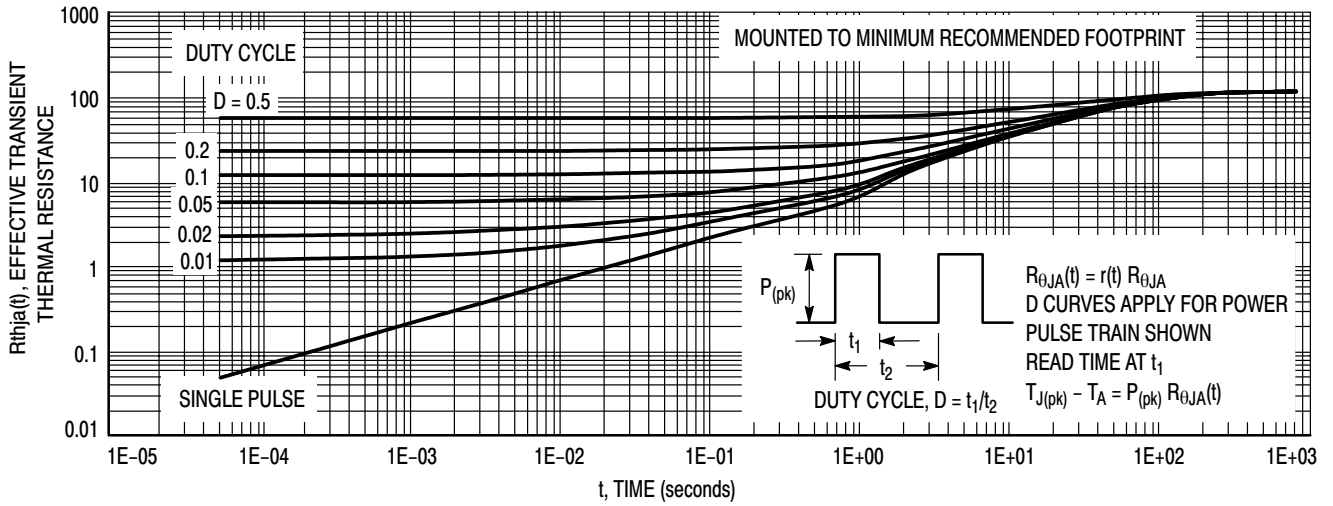
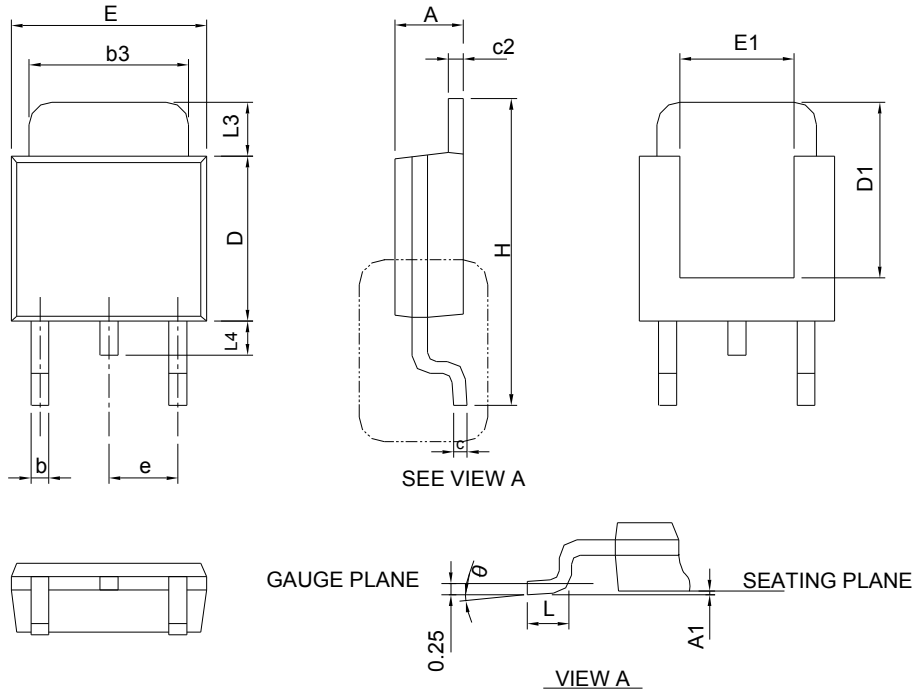


Figure 13. Thermal Response - Various Duty Cycles

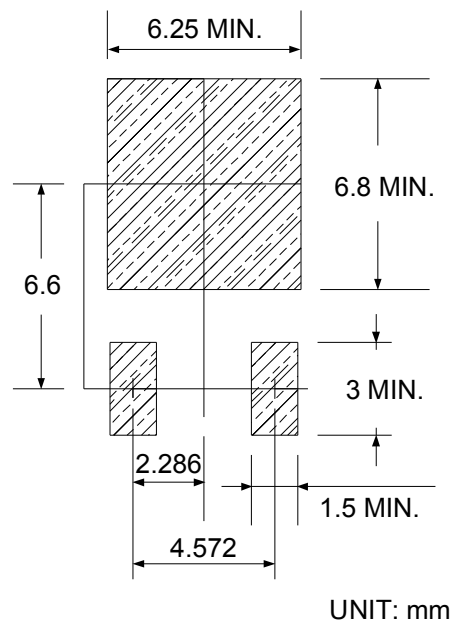
## Package Information

TO-252



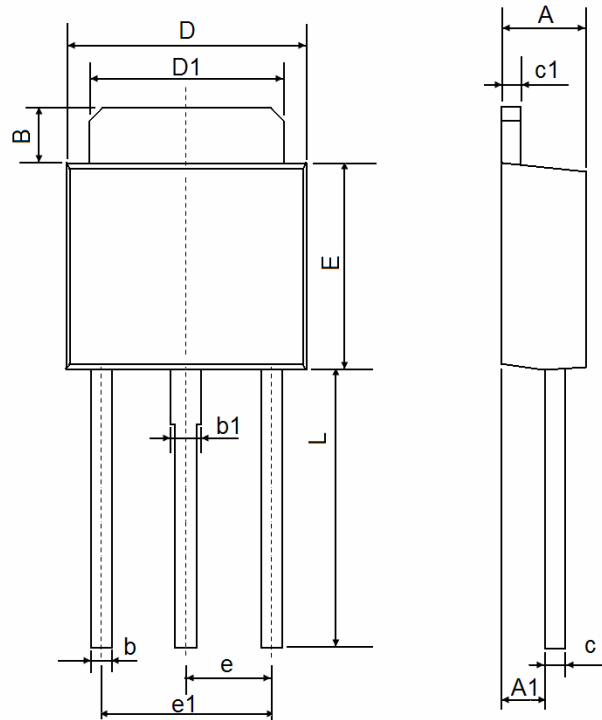
DIMENSIONS	TO-252			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	2.18	2.39	0.086	0.094
A1		0.13		0.005
b	0.50	0.89	0.020	0.035
b3	4.95	5.46	0.195	0.215
c	0.46	0.61	0.018	0.024
c2	0.46	0.89	0.018	0.035
D	5.33	6.22	0.210	0.245
D1	4.57	6.00	0.180	0.236
E	6.35	6.73	0.250	0.265
E1	3.81	6.00	0.150	0.236
e	2.29 BSC		0.090 BSC	
H	9.40	10.41	0.370	0.410
L	0.90	1.78	0.035	0.070
L3	0.89	2.03	0.035	0.080
L4		1.02		0.040
θ	0°	8°	0°	8°

### RECOMMENDED LAND PATTERN



Note : Follow JEDEC TO-252 .

**TO-251 Package Information**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	1.050	1.350	0.042	0.054
B	0.700	1.000	0.028	0.040
b	0.500	0.700	0.020	0.028
b1	0.700	0.900	0.028	0.035
c	0.430	0.580	0.017	0.023
c1	0.430	0.580	0.017	0.023
D	6.350	6.650	0.250	0.262
D1	5.200	5.400	0.205	0.213
E	5.400	6.000	0.213	0.237
e	2.300 TYP.		0.091 TYP.	
e1	4.500	4.700	0.177	0.185
L	4.900	9.400	0.194	0.372

**Notes**

1. All dimensions are in millimeters.
2. Tolerance  $\pm 0.10\text{mm}$  (4 mil) unless otherwise specified
3. Package body sizes exclude mold flash and gate burrs. Mold flash at the non-lead sides should be less than 5 mils.
4. Dimension L is measured in gauge plane.
5. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact