
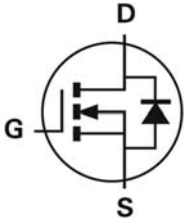



<b>V<sub>DSS</sub> , 60V</b> <b>R<sub>DS(ON)</sub> , 9.5mΩ (max.) @ V<sub>GS</sub>=10V</b> <b>R<sub>DS(ON)</sub> , 11.5mΩ (max.) @ V<sub>GS</sub>=4.5V</b> <b>I<sub>D</sub> , 75A</b>	<b>TO-220AB</b>	 
		

Description	Features
<p>The SG60N15P uses advanced Trench technology and designs to provide excellent R<sub>DS(ON)</sub> with low gate charge. This device is suitable for use in PWM, load switching and general purpose applications.</p>	<ul style="list-style-type: none"> <li>• Low On-Resistance</li> <li>• Low Input Capacitance</li> <li>• Low Miller Charge</li> <li>• Low Input / Output Leakage</li> <li>• Pb-free lead plating; RoHS compliant</li> </ul>
	Applications
	<ul style="list-style-type: none"> <li>• Motor / Body Load Control</li> <li>• Automotive Systems</li> <li>• Load Switch</li> <li>• DC-DC converters and Off-line UPS</li> </ul>

### Ordering Information

Ordering Code	RoHS Status	Package	Package Code	Packing	Quantity
SG60N15P	Halogen-Free	TO-220AB	P	Tube	50

### Absolute Maximum Ratings (T<sub>A</sub>=25°C unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V <sub>DS</sub>	60	V
Gate-Source Voltage	V <sub>GS</sub>	±20	V
Drain Current-Continuous	I <sub>D</sub>	T <sub>C</sub> =25°C	75
		T <sub>C</sub> =100°C	47
Drain Current-Pulsed <sup>Note 1</sup>	I <sub>DM</sub>	150	A
Avalanche Current	I <sub>AS</sub>	35	A
Avalanche Energy, L=0.1mH	E <sub>AS</sub>	61	mJ
Maximum Power Dissipation	P <sub>D</sub>	T <sub>C</sub> =25°C	86.8
		T <sub>C</sub> =100°C	34.7
Storage Temperature Range	T <sub>STG</sub>	-55 to +150	°C
Operating Junction Temperature Range	T <sub>J</sub>	-55 to +150	°C

### Thermal Resistance Ratings

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Maximum Junction-to-Ambient	R <sub>θJA</sub>	Steady State	-	-	62	°C/W
Maximum Junction-to-Case	R <sub>θJC</sub>	Steady State	-	-	1.44	°C/W

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

OFF CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>DS</sub> =250μA	60	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =48V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA

ON CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250μA	1.3	1.7	2.4	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>DS</sub> =11A	-	-	9.5	mΩ
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =4.5V, I <sub>DS</sub> =8A	-	-	11.5	mΩ

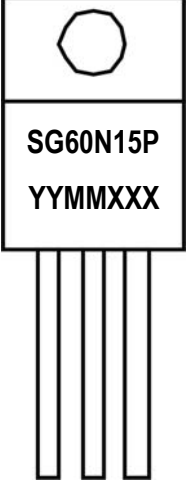
DYNAMIC CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =30V, V <sub>GS</sub> =0V, f=1MHz	-	1486	-	pF
Output Capacitance	C <sub>oss</sub>		-	123	-	
Reverse Transfer Capacitance	C <sub>rss</sub>		-	71	-	

SWITCHING CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Turn-On Delay Time	T <sub>d(on)</sub>	V <sub>GS</sub> =10V, V <sub>DS</sub> =30V, R <sub>L</sub> =5Ω, R <sub>GEN</sub> =3Ω	-	14.8	-	ns
Rise Time	t <sub>r</sub>		-	127	-	
Turn-Off Delay Time	T <sub>d(off)</sub>		-	54.2	-	
Fall Time	t <sub>f</sub>		-	75.9	-	
Total Gate Charge	Q <sub>g</sub>	V <sub>GS</sub> =10V, V <sub>DS</sub> =30V, I <sub>D</sub> =12A	-	68	-	nC
Gate to Source Gate Charge	Q <sub>gs</sub>		-	15.6	-	
Gate to Drain "Miller" Charge	Q <sub>gd</sub>		-	18	-	
Gate resistance	R <sub>g</sub>	V <sub>DS</sub> =0V, V <sub>GS</sub> =0V, f=1MHz	-	1.5	-	Ω

DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain-Source Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =12A	-	-	1	V
Continuous Source Current	I <sub>S</sub>	V <sub>G</sub> =V <sub>D</sub> =0V, Force Current	-	-	52	A
Pulsed Source Current	I <sub>SM</sub>		-	-	120	A

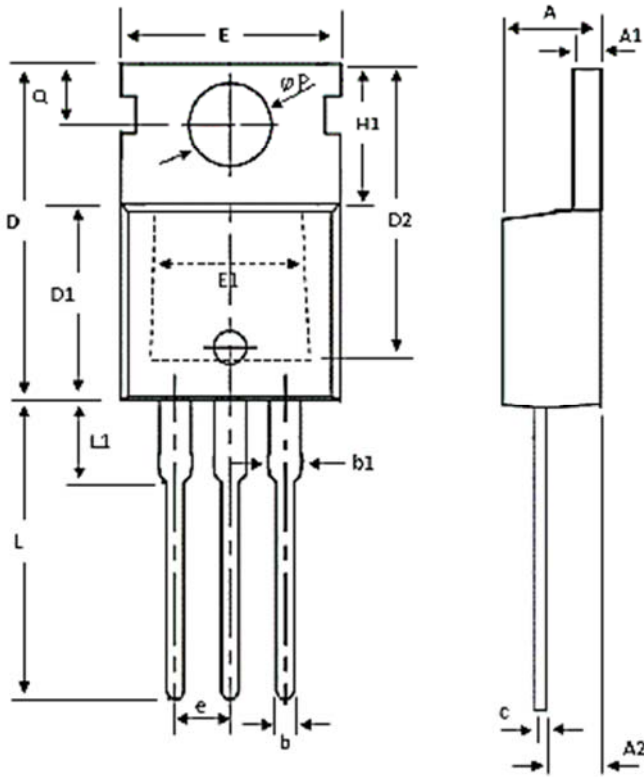
- Notes:**
- Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
  - R<sub>θJA</sub> is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. R<sub>θJC</sub> is guaranteed by design while R<sub>θJA</sub> is determined by the user's board design. R<sub>θJA</sub> shown below for single device operation on FR-4 in still air.

**Marking Information**

TO-220AB (P)	Marking Rule
<p>Laser Marking</p>  <p>Diagram</p>	<p><u>Line 1</u> : Device SG60N15P</p> <p><u>Line 2</u> : Date Code YYMMXXX</p> <p>YY : Year Code MM : Month XXX : Serial Number</p>

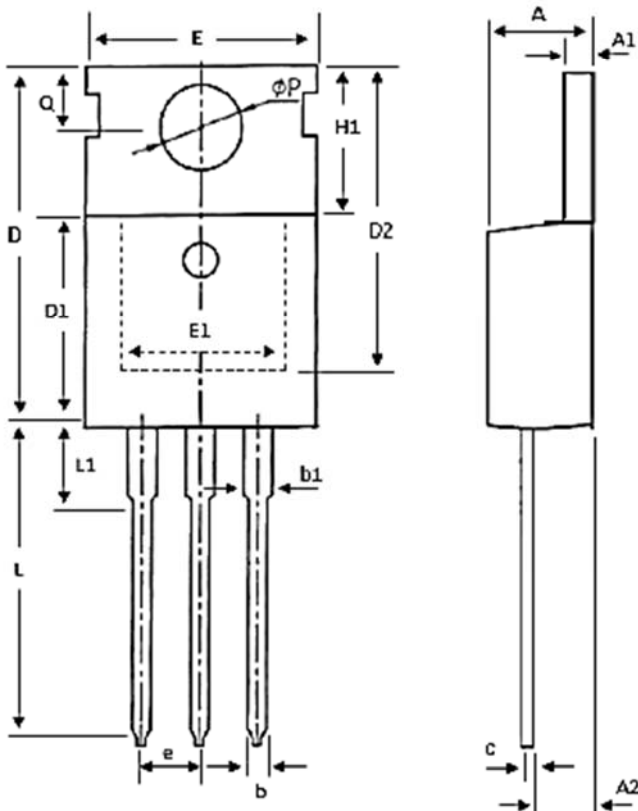
Package of Dimension

G-TYPE



Symbol	Min	Nor	Max
A	4.20	4.45	4.70
A1	1.15	1.28	1.40
A2	2.20	2.45	2.70
b	0.70	0.83	0.95
b1	1.15	1.45	1.75
c	0.40	0.50	0.60
D1	8.80	9.10	9.40
D2	11.75	-	-
E	9.70	10.03	10.36
E1	6.86	-	-
e	2.54 BSC		
H1	6.25	6.55	6.85
L	12.75	13.38	14.00
L1	-	-	4.00
P	3.40	3.70	4.00
Q	2.60	2.80	3.00

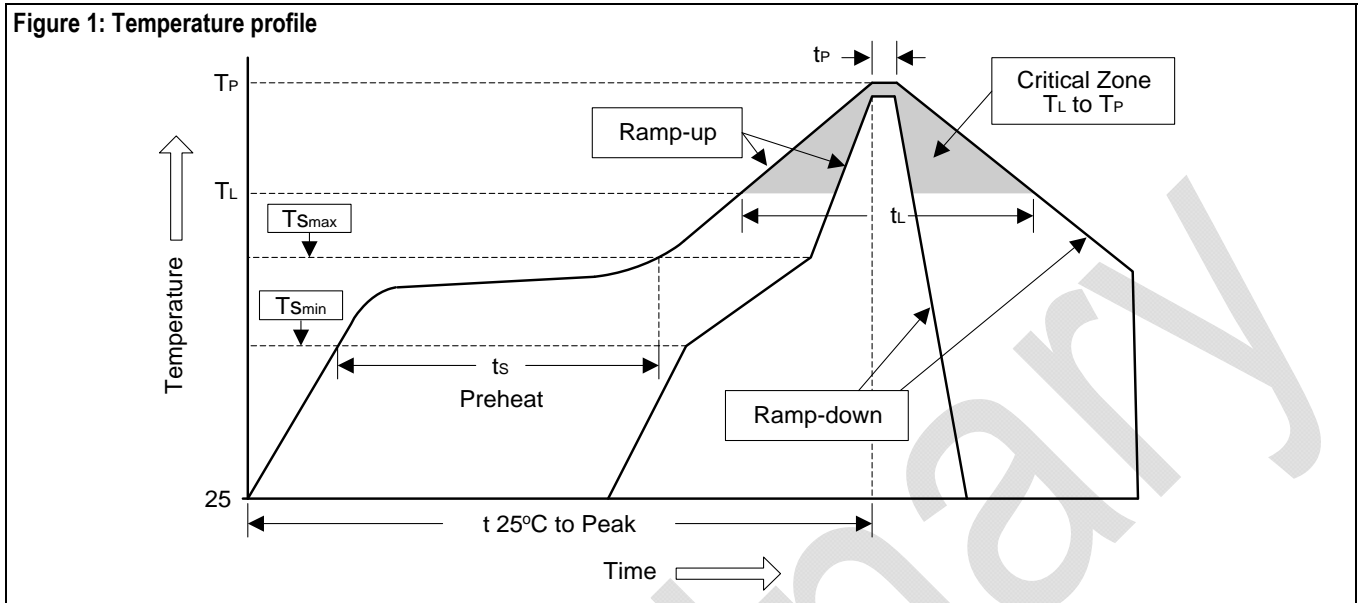
P-TYPE  
H-TYPE



## Soldering Methods for Silicongear's Products

1. Storage environment: Temperature=10°C to 35°C Humidity=65%±15%
2. Reflow soldering of surface-mount devices

Figure 1: Temperature profile



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate ( $T_L$ to $T_P$ )	<3°C/sec	<3°C/sec
Preheat		
- Temperature Min ( $T_{Smin}$ )	100°C	150°C
- Temperature Max ( $T_{Smax}$ )	150°C	200°C
- Time (min to max) ( $t_s$ )	60 to 120 sec	60 to 180 sec
$T_{Smax}$ to $T_L$		
- Ramp-up Rate	<3°C/sec	<3°C/sec
Time maintained above:		
- Temperature ( $T_L$ )	183°C	217°C
- Time ( $t_L$ )	60 to 150 sec	60 to 150 sec
Peak Temperature ( $T_P$ )	240°C +0/-5°C	260°C +0/-5°C
Time within 5°C of actual Peak Temperature ( $t_P$ )	10 to 30 sec	20 to 40 sec
Ramp-down Rate	<6°C/sec	<6°C/sec
Time 25°C to Peak Temperature	<6 minutes	<8 minutes

### 3. Flow (wave) soldering (solder dipping)

Products	Peak Temperature	Dipping Time
Pb devices.	245°C ±5°C	5sec ±1sec
Pb-Free devices.	260°C +0/-5°C	5sec ±1sec

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