

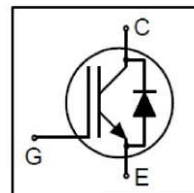
Product Summary	
V_{CES}	600V
I_C	15A
$V_{CE(sat),typ}$	1.5V ($T_J = 25^\circ\text{C}$)
Package	DTGP15N60: TO-220 DTGF15N60: TO-220F DTGK15N60: TO-263

Features

- Low $V_{CE(sat)}$
- Fast Switching
- High Ruggedness
- Short-circuit Rated

Applications

- Home Appliances
- Compressors / Air Conditioning
- Motor Control
- General Purpose Inverters



Absolute Maximum Ratings

Parameter	Symbol	Limit	Unit
Collector-to-Emitter Voltage	V_{CES}	600	V
Gate-to-Emitter Voltage	V_{GES}	± 20	
DC Collector Current ($T_c = 100^\circ\text{C}$, limited by max T_J)	TO-220, TO-263	18.5	A
	TO-220F	10	
Pulsed Collector Current (pulse width limited by max T_J)	I_{CM}	60	
Diode Forward Current ($T_c = 100^\circ\text{C}$, limited by max T_J)	TO-220, TO-263	20	A
	TO-220F	10	
Diode Pulsed Current (pulse width limited by max T_J)	I_{FM}	60	
Maximum Power Dissipation ($T_c = 25^\circ\text{C}$, $T_J = 150^\circ\text{C}$)	TO-220, TO-263	114	W
	TO-220F	45	
Operating Junction Temperature	T_J	-40 to +150	$^\circ\text{C}$
Storage Temperature	T_{stg}	-40 to +150	

Static Electrical Characteristics ⁽¹⁾

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-to-Emitter Breakdown Voltage	BV_{CES}	$V_{GE} = 0V, I_C = 250\mu A$	600	-	-	V
Collector-to-Emitter Leakage Current	I_{CES}	$V_{CE} = 600V, V_{GE} = 0V$	-	-	10	μA
		$V_{CE} = 600V, V_{GE} = 0V$ $T_J = 125^\circ C$	-	-	250	
Gate-to-Emitter Leakage Current	I_{GES}	$V_{CE} = 0V, V_{GE} = \pm 20V$	-	-	100	nA
Gate Threshold Voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C = 250\mu A$	5.0	6.0	7.0	V
Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE} = 15V, I_C = 15A$	-	1.5	1.9	V
		$V_{GE} = 15V, I_C = 15A,$ $T_J = 125^\circ C$	-	1.8	-	
Diode Forward Voltage	V_F	$V_{GE} = 0V, I_F = 15A$	-	1.6	2.1	V
		$V_{GE} = 0V, I_F = 15A$ $T_J = 125^\circ C$	-	1.4	-	

Thermal Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Junction-to-Ambient Thermal Resistance (TO-220, TO-263)	$R_{\theta JA}$	-	-	62	$^\circ C/W$
Junction-to-Case Thermal Resistance (TO-220, TO-263), IGBT	$R_{\theta JC}$	-	-	1.1	
Junction-to-Case Thermal Resistance (TO-220, TO-263), Diode		-	-	1.4	
Junction-to-Ambient Thermal Resistance (TO-220F)	$R_{\theta JA}$	-	-	65	
Junction-to-Case Thermal Resistance (TO-220F), IGBT	$R_{\theta JC}$	-	-	2.8	
Junction-to-Case Thermal Resistance (TO-220F), Diode		-	-	3.5	

Dynamic Electrical Characteristics ⁽¹⁾

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Total Gate Charge	Q_G	$V_{CC} = 400V,$ $V_{GE} = 15V,$ $I_C = 15A$	-	45	-	nC
Input Capacitance	C_{iss}	$V_{CE} = 30V,$ $V_{GE} = 0V,$ $f = 1MHz$	-	930	-	pF
Output Capacitance	C_{oss}		-	85	-	
Reverse Transfer Capacitance	C_{riss}		-	16	-	

Switching Characteristics, Inductive Load ^{(1), (2)}

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Turn-on delay time	$t_{d(ON)}$	$V_{CC} = 400V,$ $V_{GE} = 0/15V,$ $R_G = 10\Omega,$ $I_C = 15A,$ $L_{load} = 3mH$ (Energy losses include "tail" and diode reverse recovery)	-	24	-	ns
Rise Time	t_r		-	19	-	
Turn-off delay time	$t_{d(OFF)}$		-	89	-	
Fall Time	t_f		-	70	-	
Turn-On Switching Loss	E_{on}		-	0.28	-	mJ
Turn-Off Switching Loss	E_{off}		-	0.28	-	
Total Switching Loss	E_{ts}		-	0.56	-	
Diode Reverse Recovery Time	t_{rr}		-	46	-	ns
Short Circuit Capability	t_{SC}	$V_{GE} = 15V, T_C = 25^\circ C$	5	10	-	μs
Short Circuit Collector Current	$I_{C(SC)}$	$V_{CC} \leq 400V, V_P \leq 600V$	-	60	-	A

(1) $T_J = 25^\circ C$ unless otherwise specified.

(2) t_r : from 10% of I_C to 90% of I_C ; t_f : from 90% of I_C to 10% of I_C ;

E_{on} : from 10% of V_{GE} to 10% of V_{CE} ; E_{off} : from 90% of V_{GE} to 10% of I_C .

Typical Electrical Characteristics

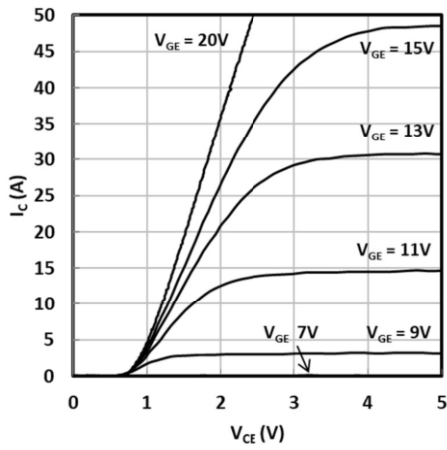


Fig. 1 Typical output characteristics

($T_J = 25\text{ }^\circ\text{C}$, $t_p = 250\text{ }\mu\text{s}$)

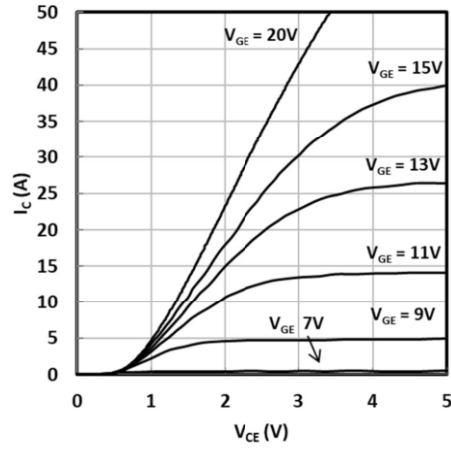


Fig. 2 Typical output characteristics

($T_J = 150\text{ }^\circ\text{C}$, $t_p = 250\text{ }\mu\text{s}$)

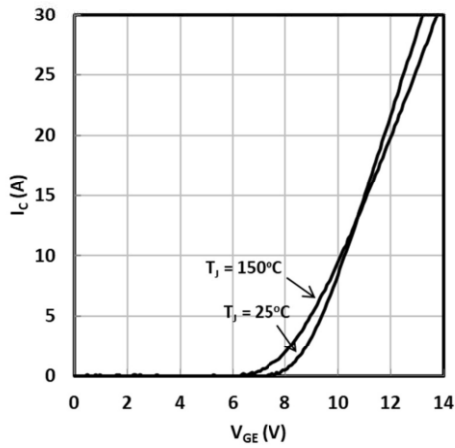


Fig. 3 Typical transfer characteristics

($V_{CE} = 20\text{ V}$, $t_p = 250\text{ }\mu\text{s}$)

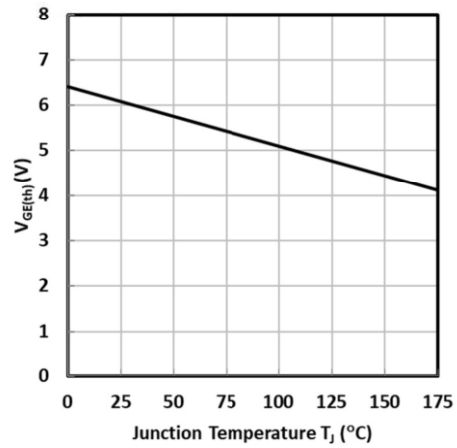


Fig. 4 Typical gate threshold voltage as a function of junction temperature

($V_{CE} = V_{GE}$, $I_C = 250\text{ }\mu\text{A}$)

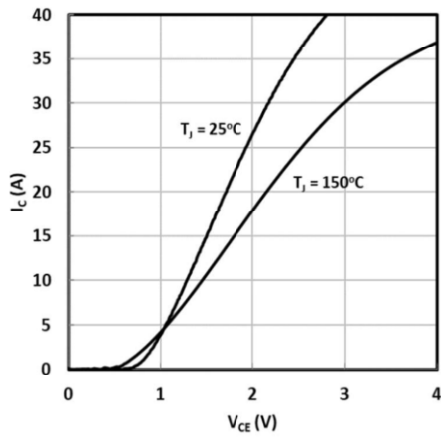


Fig. 5 Typical saturation voltage characteristics
($V_{GE} = 15\text{ V}$, $t_p = 250\ \mu\text{s}$)

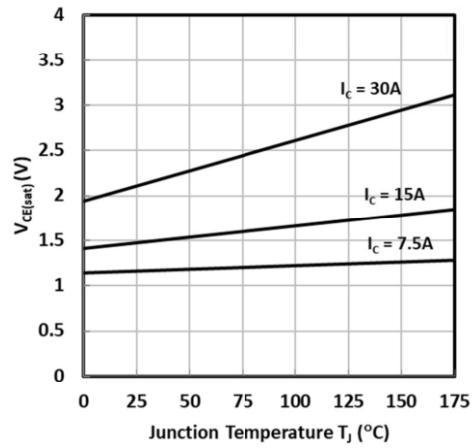


Fig. 6 Typical saturation voltage as a function of junction temperature
($V_{GE} = 15\text{ V}$, $t_p = 250\ \mu\text{s}$)

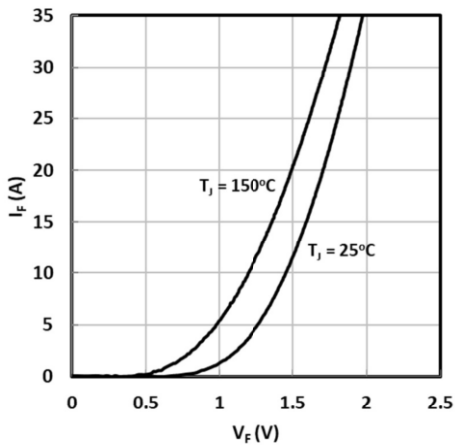


Fig. 7 Typical diode forward current as a function of forward voltage
($V_{GE} = 0\text{ V}$, $t_p = 250\ \mu\text{s}$)

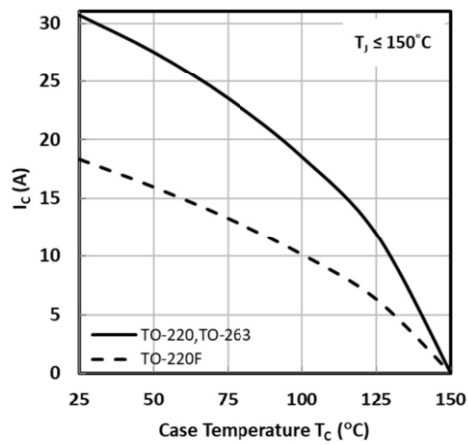


Fig. 8 Maximum DC collector current as a function of case temperature

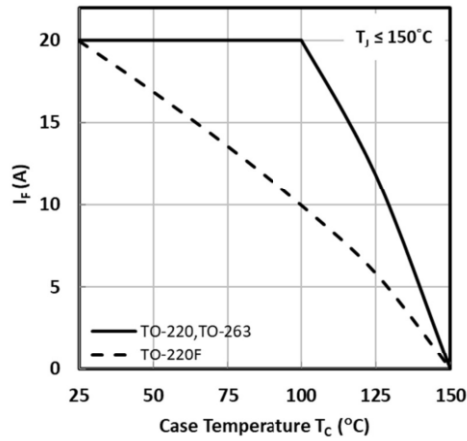


Fig. 9 Maximum DC diode forward current as a function of case temperature
(I_F limited by bonding wire)

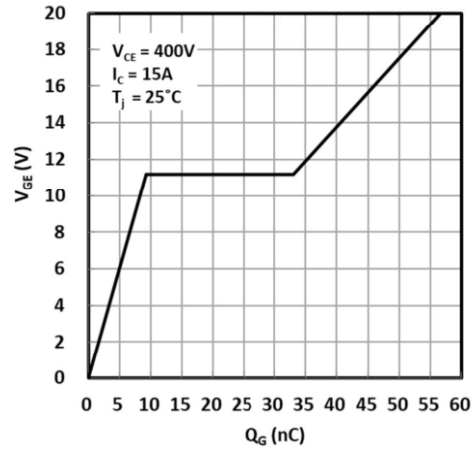


Fig. 10 Typical gate charge characteristics

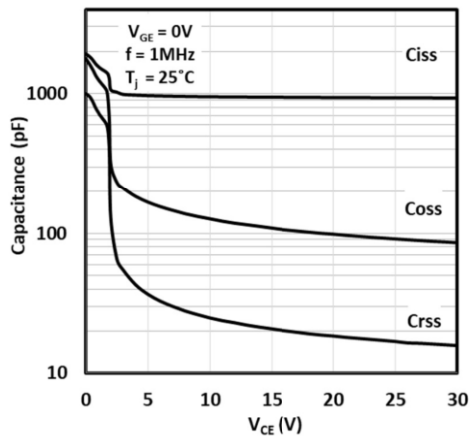
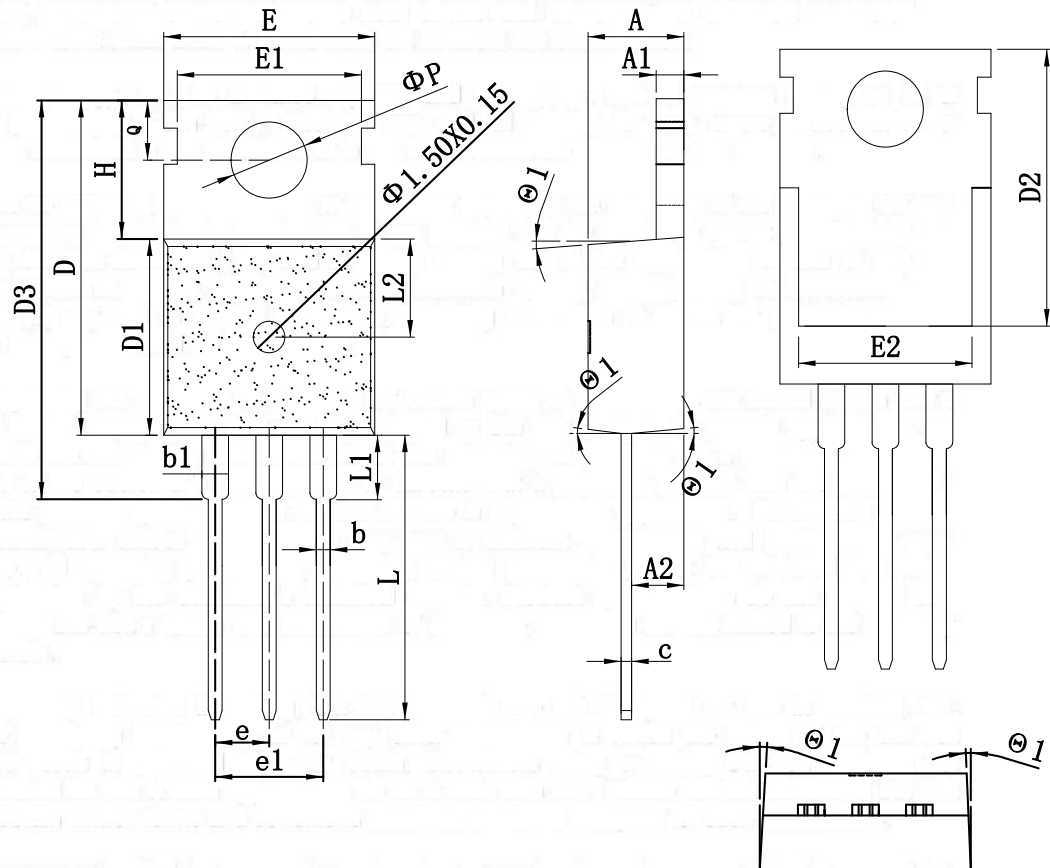


Fig. 11 Typical capacitance as a function of collector-to-emitter voltage

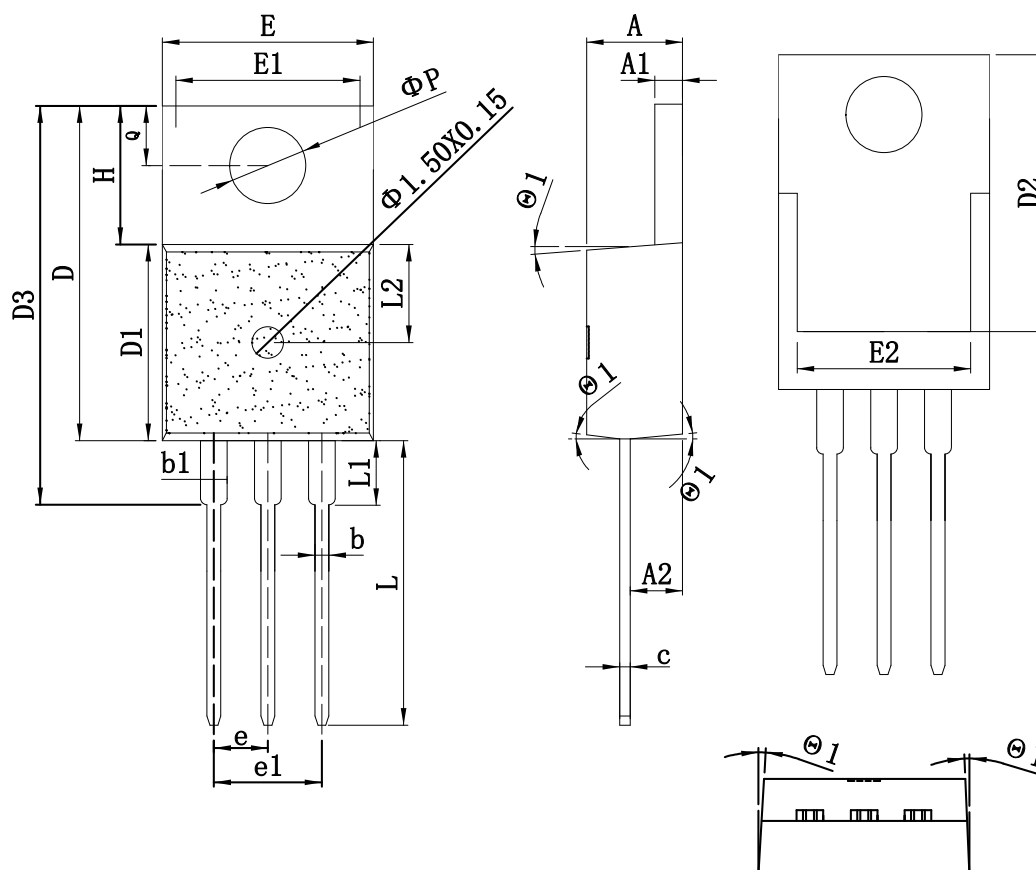
TO-220_3L-A PACKAGE OUTLINE



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	mm			SYMBOL	mm		
	MIN	TYP	MAX		MIN	TYP	MAX
A	4.15	4.50	4.80	E1	8.25	8.70	9.15
A1	1.15	1.30	1.50	E2	7.20	8.00	8.80
A2	2.10	2.40	2.65	e	2.38	2.54	2.74
b	0.65	0.80	1.00	e1	5.08REF		
b1	1.10	1.33	1.80	H	6.20	6.50	6.90
c	0.35	0.50	0.65	L	12.75	13.28	13.70
D	14.25	15.75	16.15	L1	-	-	3.50
D1	8.70	9.20	9.60	L2	2.30	4.65	7.00
D2	12.30	13.10	13.85	ϕP	3.40	3.65	3.85
D3	16.20	18.80	20.60	Q	2.50	2.80	3.00
E	8.68	10.02	11.00	θ	2°	-	7°

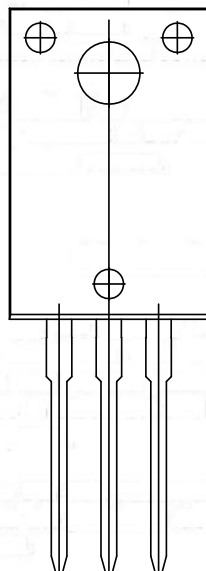
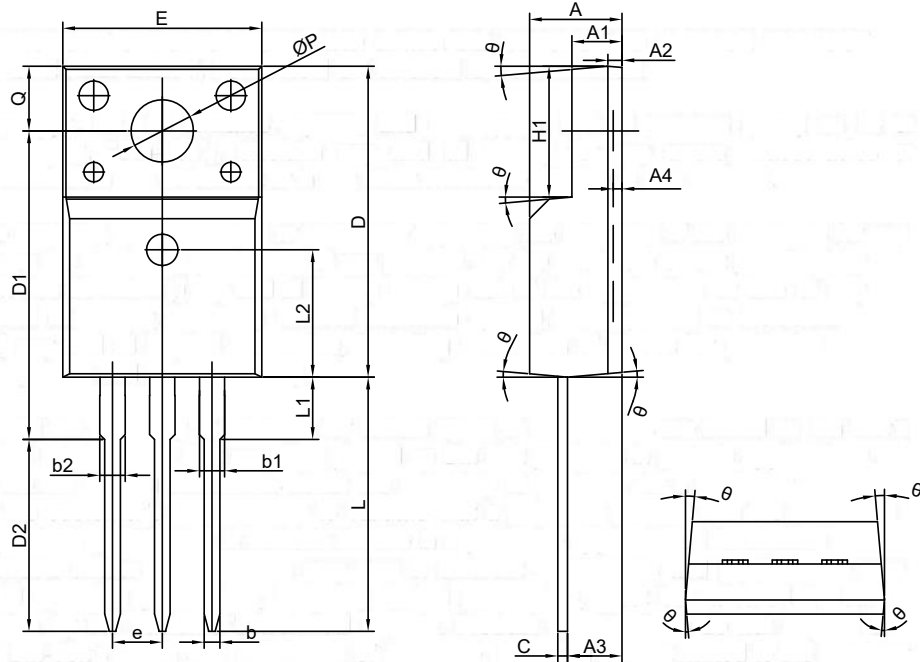
TO-220_3L-B PACKAGE OUTLINE



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	mm			SYMBOL	mm		
	MIN	TYP	MAX		MIN	TYP	MAX
A	4.15	4.50	4.80	E1	8.25	8.70	9.15
A1	1.15	1.30	1.50	E2	7.20	8.00	8.80
A2	2.10	2.40	2.65	e	2.38	2.54	2.74
b	0.65	0.80	1.00	e1	5.08REF		
b1	1.10	1.33	1.80	H	6.20	6.50	6.90
c	0.35	0.50	0.65	L	12.75	13.28	13.70
D	14.25	15.75	16.15	L1	-	-	3.50
D1	8.70	9.20	9.60	L2	2.30	4.65	7.00
D2	12.30	13.10	13.85	ϕP	3.40	3.65	3.85
D3	16.20	18.80	20.60	Q	2.50	2.80	3.00
E	8.68	10.02	11.00	θ	2°	-	7°

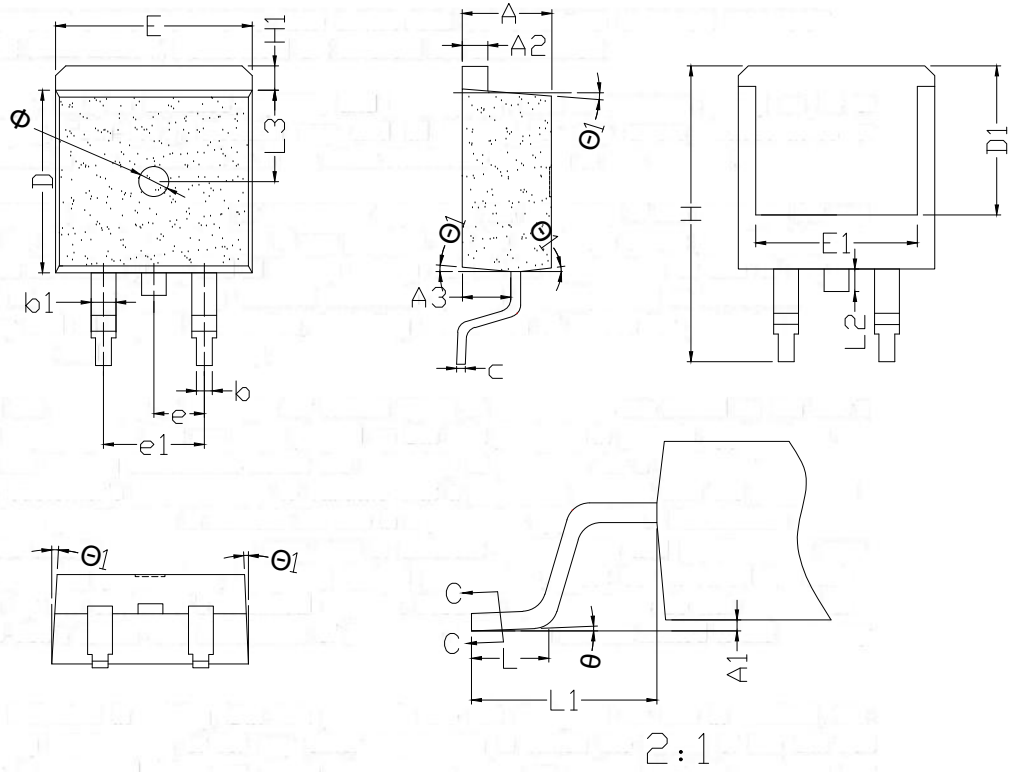
TO-220F-3L PACKAGE OUTLINE



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	4.30	4.72	5.10
A1	2.25	2.56	2.90
A2	0.72 REF		
A3	2.28	2.78	3.50
A4	0.45 MAX		
b	0.65	-	0.95
b1	1.00	-	1.55
b2	-	-	1.55
c	0.40	0.50	0.65
D	15.47	15.87	16.37
D1	15.35	15.75	16.25
E	9.76	10.16	10.76
e	2.54 BSC		
H1	6.28	6.68	7.08
L	12.48	12.98	13.50
L1	2.90	-	3.80
L2	2.54 BSC		
ØP	2.98	3.18	3.50
Q	3.00	-	3.60
θ	3°	5°	7°

TO-263 PACKAGE OUTLINE



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	TYP	MAX	SYMBOL	MIN	TYP	MAX
A	4.10	4.50	4.80	e	2.35	2.54	2.75
A1	0.00	0.10	0.30	e1	5.08REF		
A2	1.10	1.30	1.50	H	14.50	15.15	16.00
A3	2.15	2.50	3.10	H1	1.00	1.28	1.75
b	0.60	0.80	1.05	L	1.80	2.23	2.90
b1	1.05	1.33	1.50	L1	4.30	4.75	5.50
c	0.33	0.50	0.66	L2	1.00	1.30	1.85
D	8.40	9.20	9.60	L3	0.90	4.65	9.00
D1	7.50REF			φ	0°	2°	5°
E	9.60	10.02	10.80	φ1	2°	-	7°
E1	7.60	9.88	10.30	Φ	1.5BSC		

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