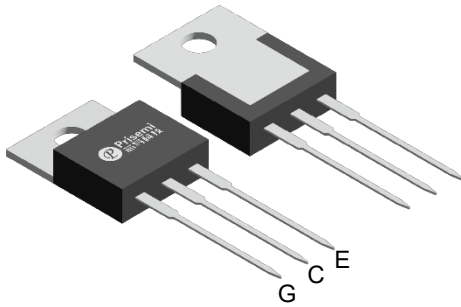
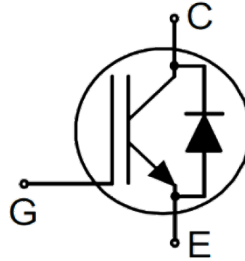
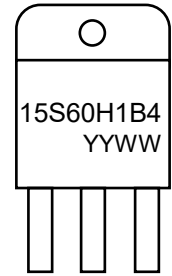


Insulate-Gate Bipolar Transistor
Description

TO-220-3L

Circuit Diagram

Marking (Top View)
Feature

- Low switching power loss
- Low switching surge and noise
- Advanced Field Stop technology
- Low EMI
- Qualified according to JEDEC for target applications
- Pb-free lead plating, halogen-free mold compound, RoHS compliant
- Internal insulation

Applications

- Industrial UPS
- Welding machine
- Solar converters
- Energy Storage
- EV Charger

Absolute maximum rating@25°C

Parameter	Symbol	Value	Units
Collector-Emitter Voltage	V_{CE}	600	V
Gate-Emitter Voltage	V_{GE}	± 20	V
Collector Current	I_C	$T_c = 25^\circ\text{C}$	30
		$T_c = 100^\circ\text{C}$	15
Pulsed Collector Current	I_{CM}	45	A
Short-Circuit Time ($V_{GE}=15\text{V}$, $V_{CC}=300\text{V}$)	T_{SC}	10	μs
Diode Forward Current	I_F	$T_c = 25^\circ\text{C}$	16
		$T_c = 100^\circ\text{C}$	8.0
Power Dissipation	P_D	109	W
Operating Junction Temperature	T_J	-55~+150	$^\circ\text{C}$
Storage Temperature	T_{STG}	-55~+150	$^\circ\text{C}$

Insulate-Gate Bipolar Transistor

PI15S60T2H1B4

Electrical characteristics per line@25°C (unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	
Collector-Emitter Breakdown Voltage	BV_{CE}	$V_{GE}=0V, I_C=250\mu A$	600	-	-	V	
C-E Leakage Current	I_{CES}	$V_{CE}=600V, V_{GE}=0V$	-	-	200	μA	
G-E Leakage Current	I_{GES}	$V_{GE}=\pm 20V, V_{CE}=0V$	-	-	± 400	nA	
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$I_C=250\mu A, V_{CE}=V_{GE}$	4.0	5.0	6.5	V	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C=15A, V_{GE}=15V$	$T_C=25^\circ C$	-	1.65	2.4	V
			$T_C=125^\circ C$	-	1.9	-	
Input Capacitance	C_{ies}	$V_{CE}=30V, V_{GE}=0V, f=1MHz$	-	950	-	pF	
Output Capacitance	C_{oes}		-	55	-		
Reverse Transfer Capacitance	C_{res}		-	16	-		
Turn-on Delay Time	$t_{d(on)}$	$V_{CE}=400V, V_{GE}=15V, R_G=10\Omega, I_C=15A$	-	14	-	ns	
Rise Time	t_r		-	41	-		
Turn-off Delay Time	$t_{d(off)}$		-	35	-		
Fall Time	t_f		-	140	-		
Turn-on Energy Loss	E_{on}	$V_{CE}=400V, V_{GE}=15V, R_G=10\Omega, I_C=15A$	-	0.66	-	mJ	
Turn-off Energy Loss	E_{off}		-	0.29	-		
Total Switching Loss	E_{st}		-	0.95	-		
Total Gate Charge	Q_g	$V_{CE}=400V, V_{GE}=15V, I_C=15A$	-	38	-	nC	
Gate to Emitter Charge	Q_{ge}		-	12	-		
Gate to Collector Charge	Q_{gc}		-	14	-		
Diode Forward Voltage	V_{FM}	$I_F=8A$	$T_C=25^\circ C$	-	1.7	2.2	V
			$T_C=125^\circ C$	-	1.4	-	
Reverse Recovery Time	t_{rr}	$I_{ES}=8A, di_{ES}/dt=200A/\mu s$	-	22	-	ns	
Reverse Recovery Charge	Q_{rr}		-	36	-	nC	

Thermal Resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal Resistance, Junction to case for IGBT	$R_{\theta JC}$	-	-	1.15	$^\circ C/W$
Thermal Resistance, Junction to case for FRD	$R_{\theta JC}$	-	-	2.0	$^\circ C/W$

Typical Characteristics

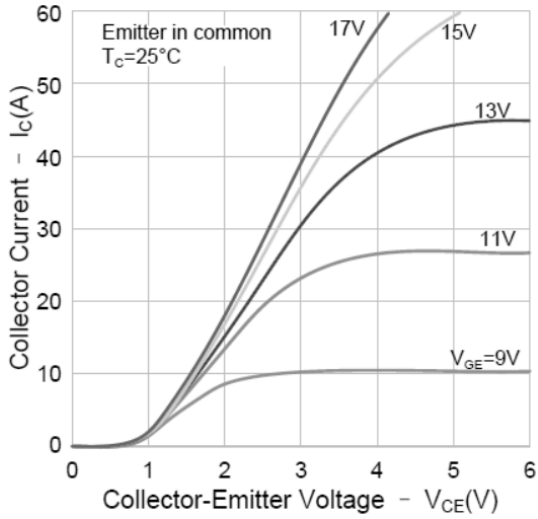


Fig 1. Output Characteristics

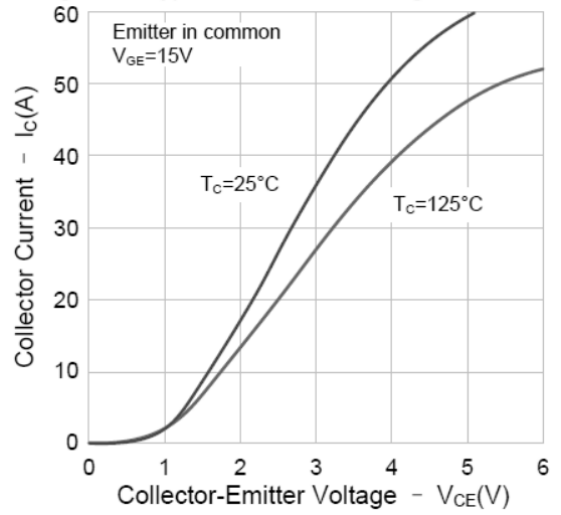


Fig 2. Saturation Voltage Characteristics

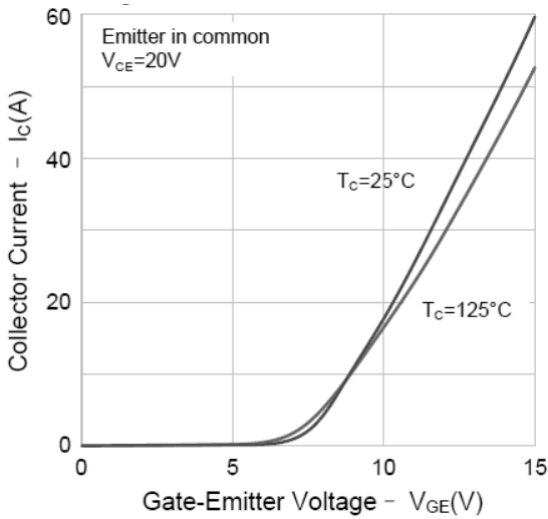


Fig 3. Transfer Characteristics

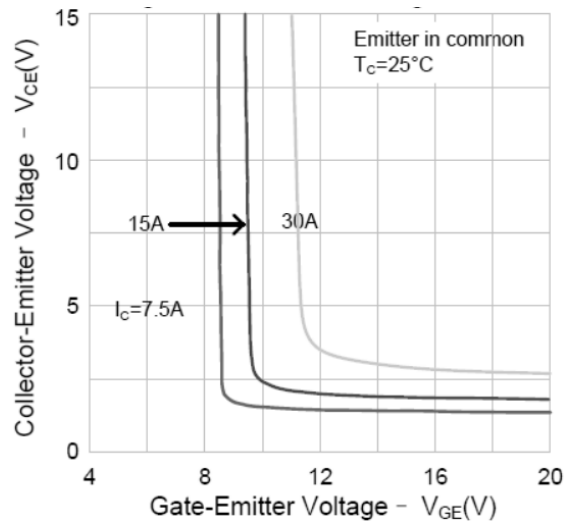


Fig 4. Saturation Voltage vs. V_{ge}

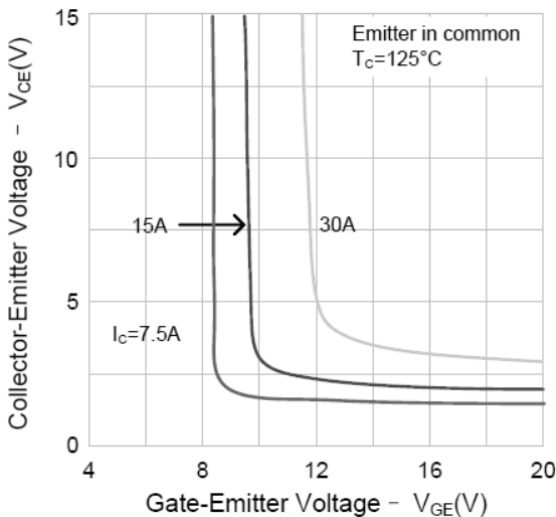


Fig 5. Saturation Voltage vs. V_{ge}

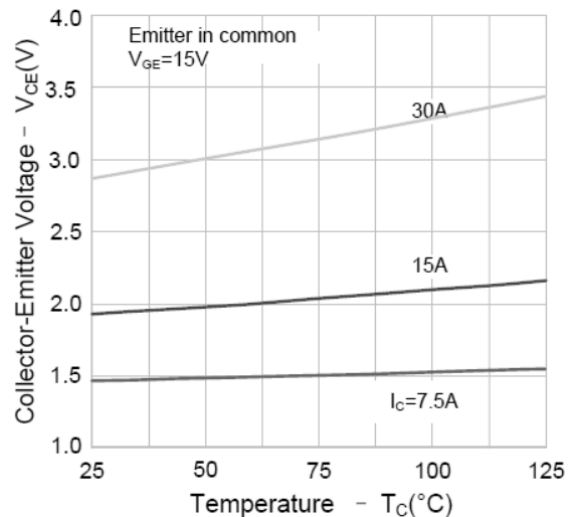


Fig 6. Saturation Voltage vs. T_c

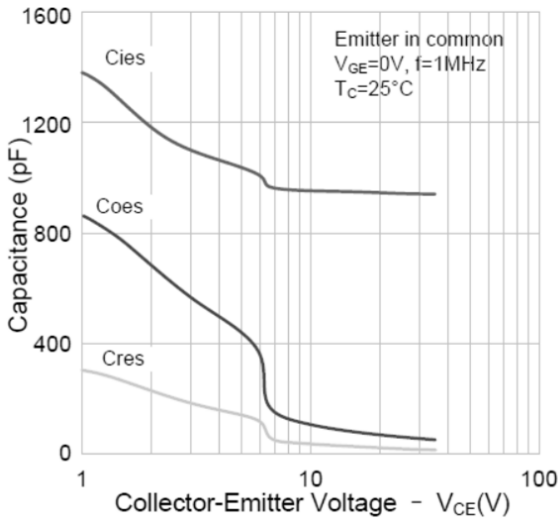


Fig 7. Capacitance Characteristics

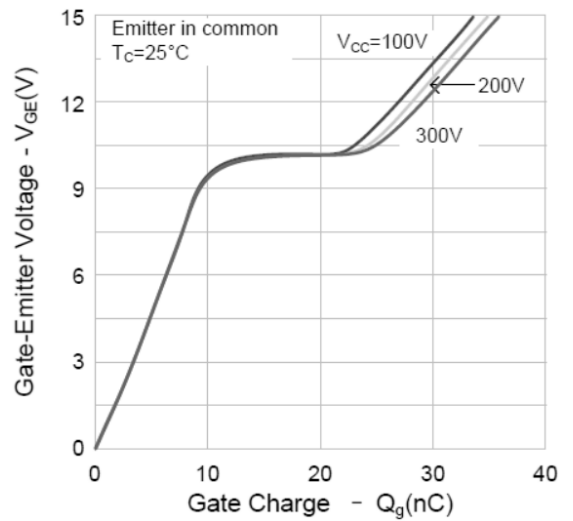


Fig 8. Gate Charge Characteristics

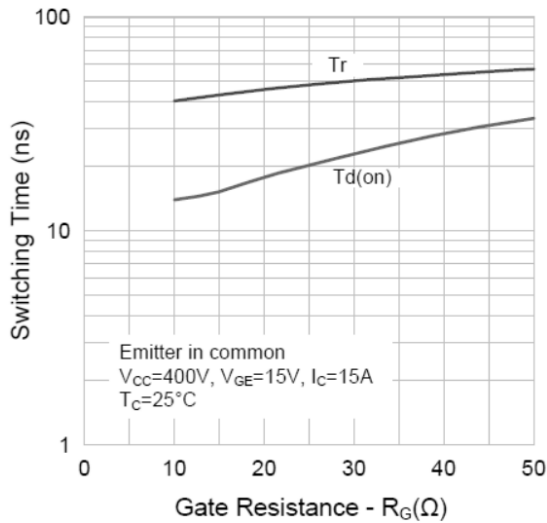


Fig 9. Turn-on Characteristics vs. Gate Resistor

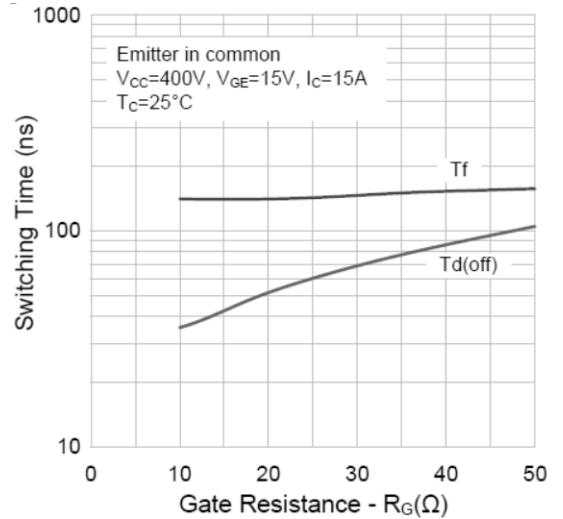


Fig 10. Turn-off Characteristics vs. Gate Resistor

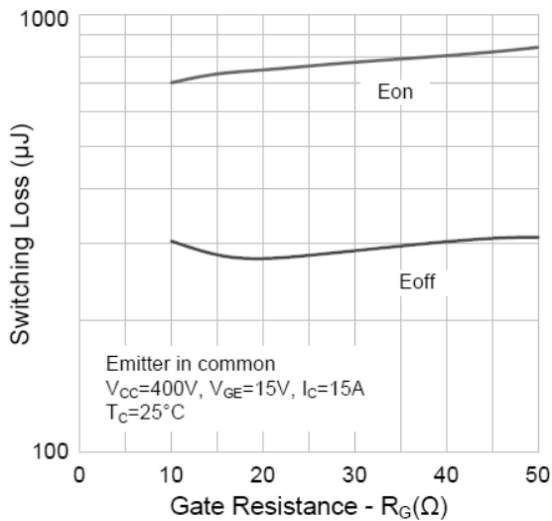


Fig 11. Switching Loss vs. Gate Resistor

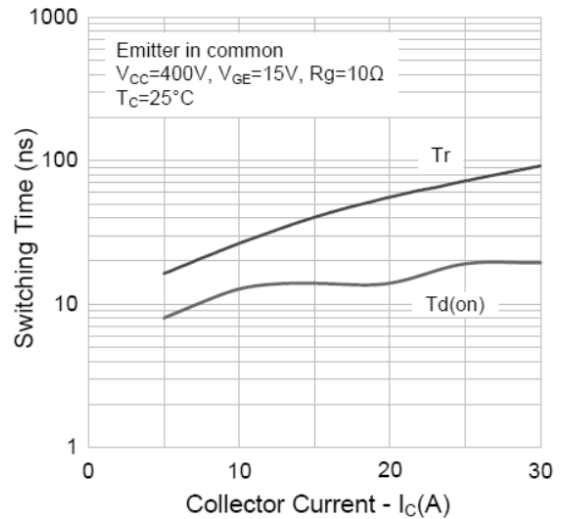


Fig 12. Turn-on Characteristics vs. Collector Current

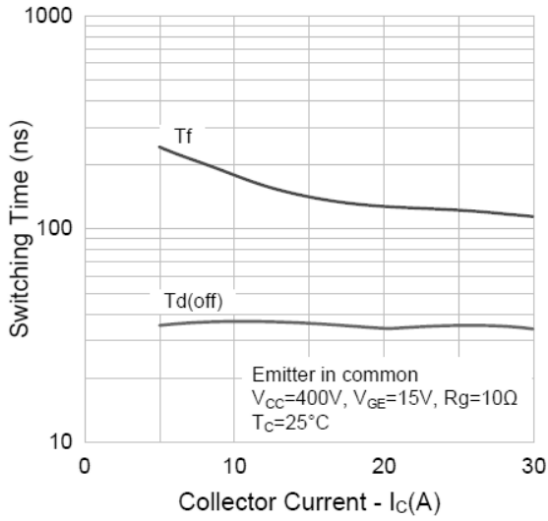


Fig 13. Turn-off Characteristics vs. Collector Current

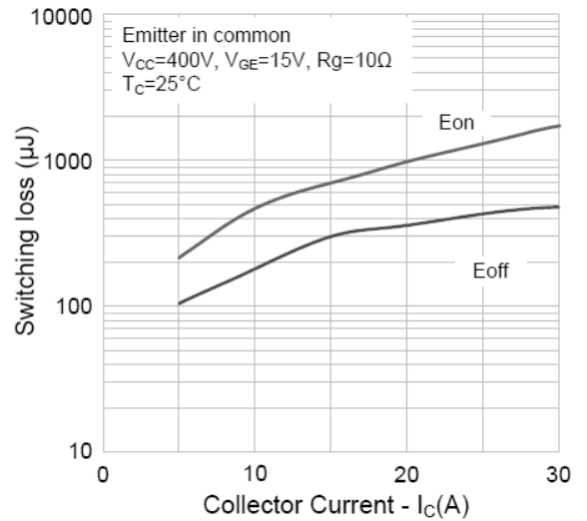


Fig 14. Switching Loss vs. Collector Current

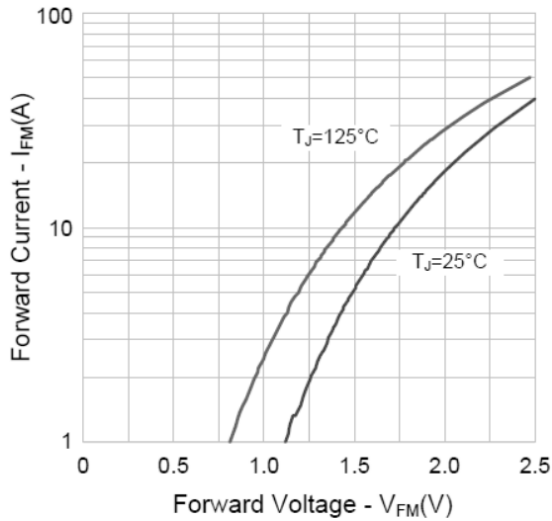


Fig 15. Forward Characteristics

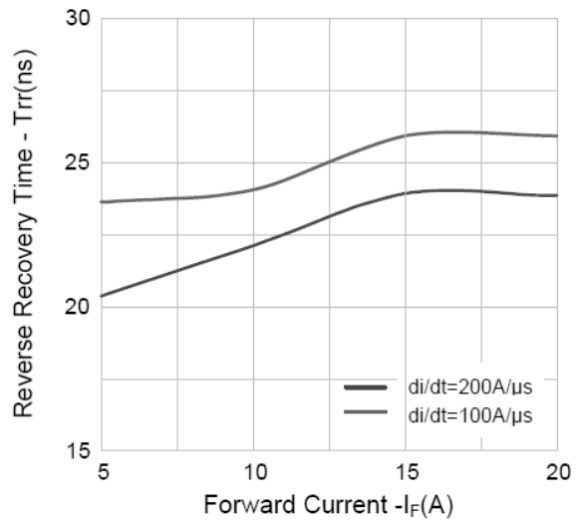


Fig 16. Reverse Recovery Time vs. Forward Current

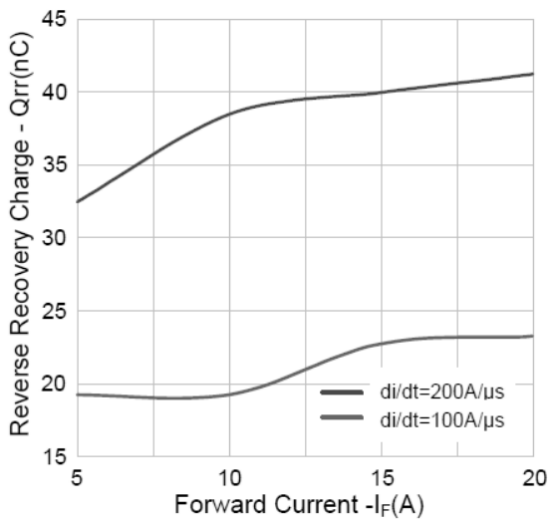


Fig 17. Reverse Recovery Time vs. Forward Current

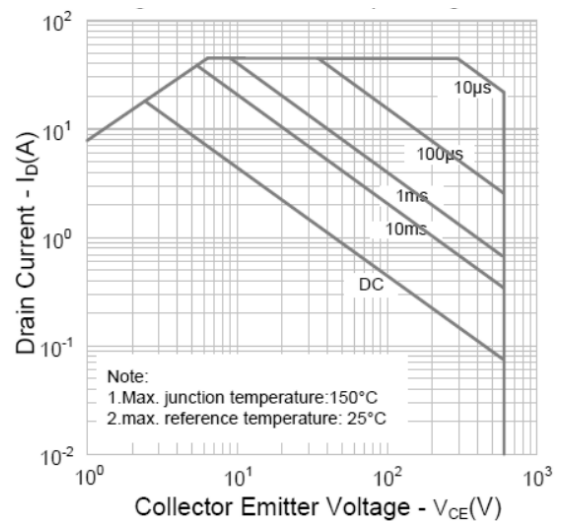


Fig 18. Max. Safe Operating Area

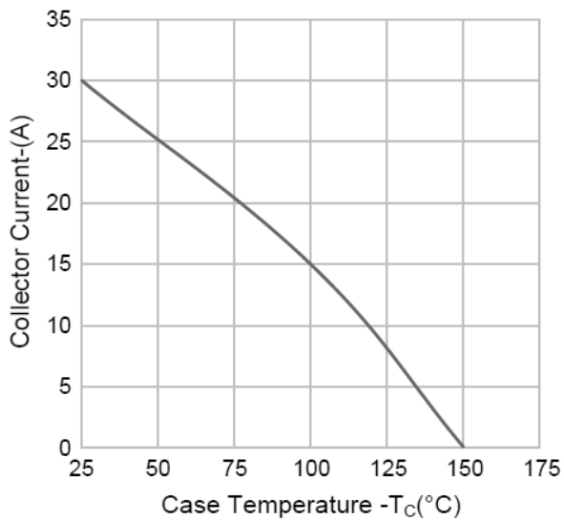
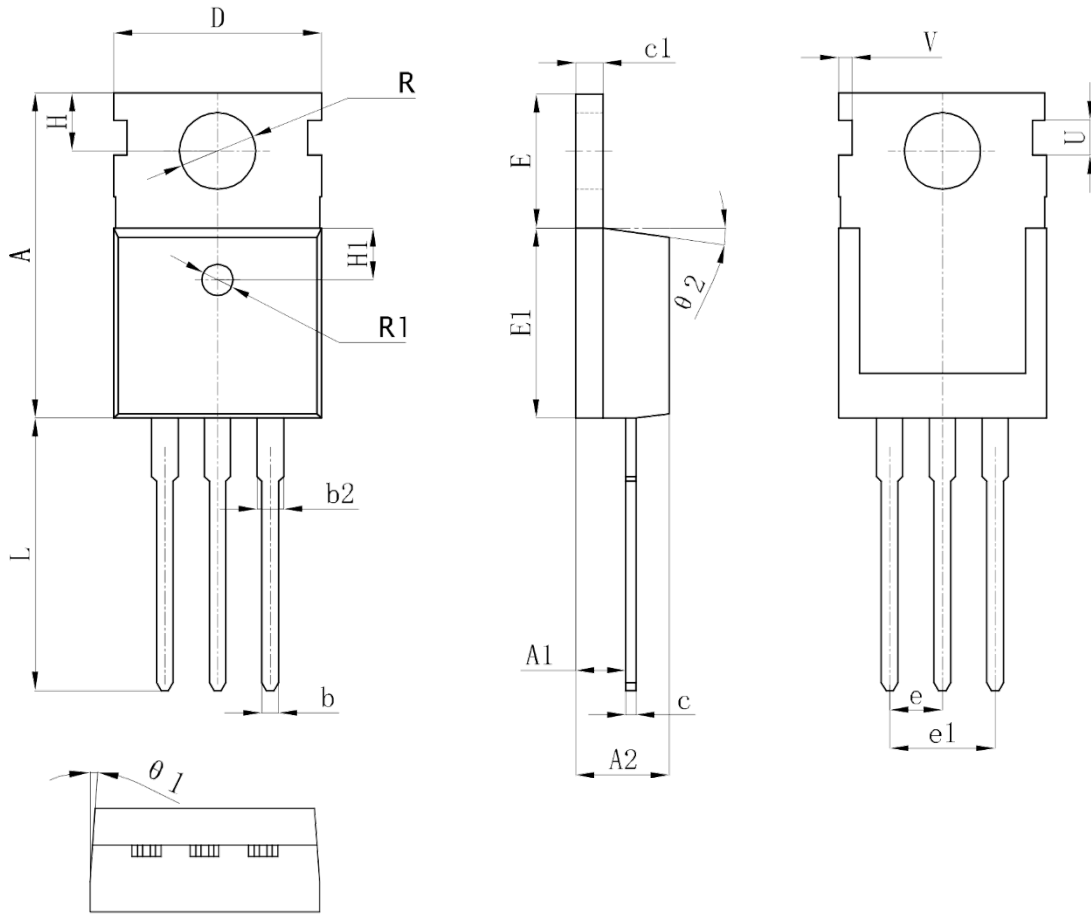



Fig 19. Current Derating Case

Product Dimension (TO-220-3L)



Dim	Millimeters		Inches		Dim	Millimeters		Inches	
	Min	Max	Min	Max		Min	Max	Min	Max
A	15.40	15.80	0.606	0.622	e1	4.84	5.32	0.191	0.209
A1	2.35	2.50	0.093	0.098	H	2.73	2.87	0.107	0.113
A2	4.40	4.70	0.173	0.185	H1	2.40	2.60	0.094	0.102
b	0.70	0.90	0.028	0.035	L	13.02	13.72	0.513	0.540
b2	1.18	1.44	0.046	0.057	R	3.50	3.63	0.138	0.143
c	0.48	0.56	0.019	0.022	R1	1.40	1.60	0.055	0.063
c1	1.29	1.32	0.051	0.052	U	1.65	1.85	0.065	0.073
D	9.80	10.20	0.386	0.402	V	0.58	0.78	0.023	0.031
E	6.40	6.60	0.252	0.260	θ1	2°	3°	2°	3°
E1	9.00	9.20	0.354	0.362	θ2	6.5°	7.5°	6.5°	7.5°
e	2.42	2.66	0.095	0.105					


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